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SEC DONOHUE

FINAL BASELINE RISK ASSESSMENT REPORT
HUMAN HEALTH EVALUATION

HI-MILL MANUFACTURING RI/FS OVERSIGHT
HIGHLAND, MICHIGAN

DECEMBER 1992

U.S. EPA Contract
68-W8-0093

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BASELINE RISK ASSESSMENT REPORT -- HUMAN HEALTH EVALUATION

Baseline Risk Assessment for the Hi-Mill Manufacturing Site

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LIST OF ACRONYMS

1,2-DCE	1,2-Dichloroethene
BCF	Bioconcentration factor
CLP	Contract Laboratory Program
CRDL	Contract Required Detection Limit
CRQL	Contract Required Quantitation Limit
EPC	Exposure Point Concentration
GC	Gas Chromatography
HEAST	Health Effects Assessment Summary Tables
HI	Hazard Index
HIF	Human Intake Factor
IDL	Instrument Detection Limit
IRIS	Integrated Risk Information System
MDPH	Michigan Department of Public Health
PbB	Blood Lead Level
RA	Risk Assessment
RDA	Recommended Dietary Allowance
RfD	Reference Dose
RI	Remedial Investigation
TAL	Target Analyte List
TCE	Trichloroethene
TCL	Target Compound List
TIC	Tentatively Identified Compound
VOC	Volatile Organic Compound

1.0 INTRODUCTION

1.1 Overview

This Baseline Risk Assessment (RA)--Human Health Evaluation is an analysis of the potential adverse health effects resulting from exposure of humans to hazardous substances found at the Hi-Mill Superfund Site located near Highland, Michigan. By definition, a baseline risk assessment evaluates risk under the no-action alternative, that is, in the absence of any remedial actions (including institutional controls) to control or mitigate releases or exposures.

The procedures used in this RA are consistent with U.S. Environmental Protection Agency (USEPA) guidance, including: Risk Assessment Guidance for Superfund, Volume I - Human Health Evaluation Manual (RAGS) (USEPA 1989a); RAGS Supplemental Guidance - Standard Default Exposure Factors (USEPA 1991a); Exposure Factors Handbook (USEPA 1989b) and Dermal Exposure Assessment Principles and Applications (USEPA 1992b). Additional USEPA guidance and other technical information have also been used and are referenced where appropriate.

1.2 Site Background

A detailed description of the Hi-Mill site, including a detailed site history and site maps, is provided in the Remedial Investigation (RI) reports for this site (Techna Corporation 1990; Geraghty and Miller 1992a). A brief summary of information that is relevant to this risk assessment is presented below.

Site Location

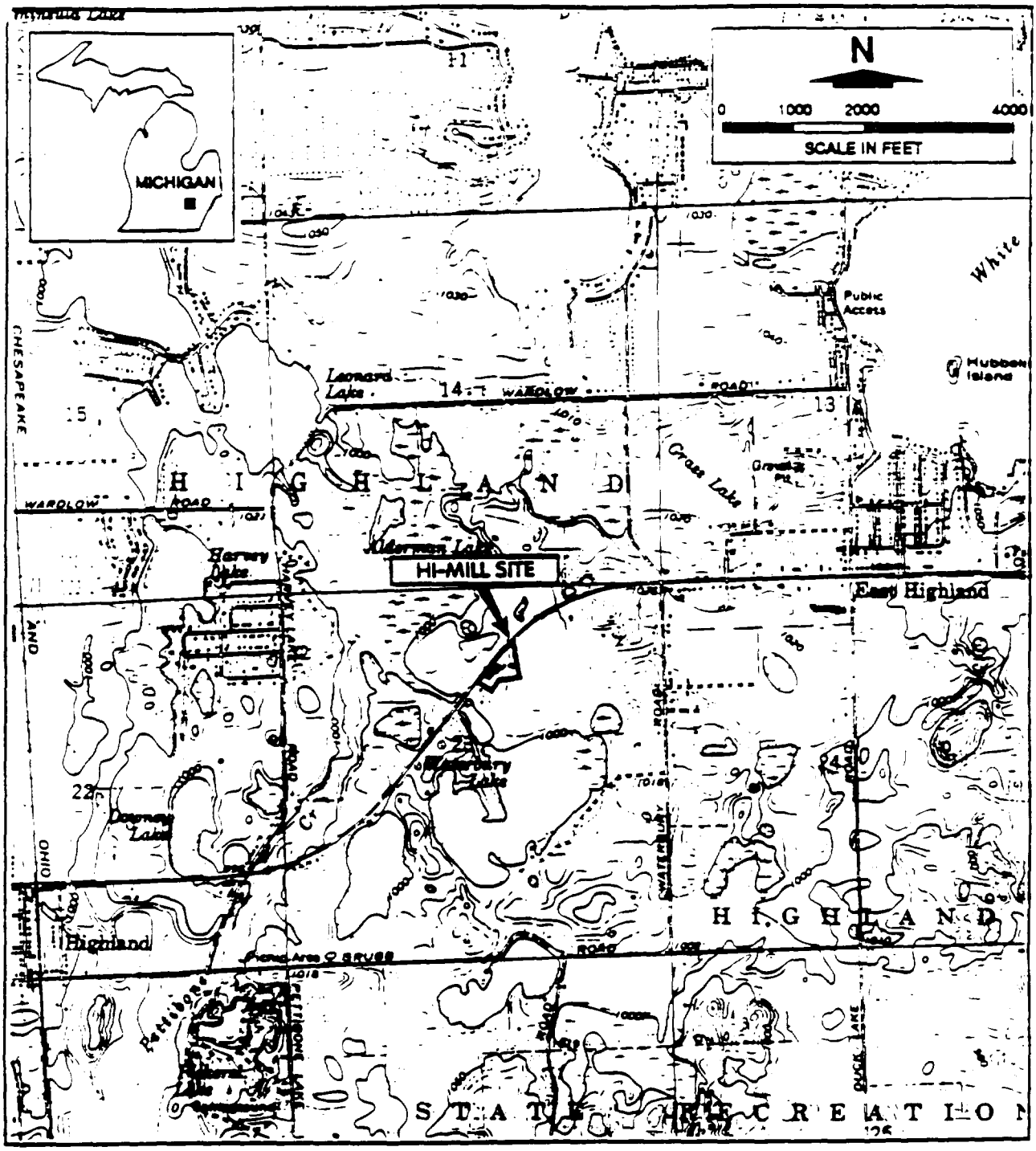
The Hi-Mill site (Figure 1-1) is a parcel of approximately 4.5 acres located immediately southeast of Highland Road (M-59) about 1.5 miles east of the town of Highland, in Oakland County, Michigan.

Site Operations

The Hi-Mill Manufacturing Company currently operates a metal parts fabrication plant at the site. The site layout is shown in Figure 1-2. Copper, aluminum and brass tubing parts and fittings have been manufactured at the plant since 1946. Soldering operations at the plant have used silver solder or aluminum bar brazing. Cleaning and pickling operations used nitric and sulfuric acids and degreasing operations used trichloroethylene (TCE). Trichloroethylene is stored onsite in an outdoor storage tank. Wastes from these operations were formerly disposed of in two on-site lagoons, which have been drained and are now vegetated.

Basis for Concern at the Site

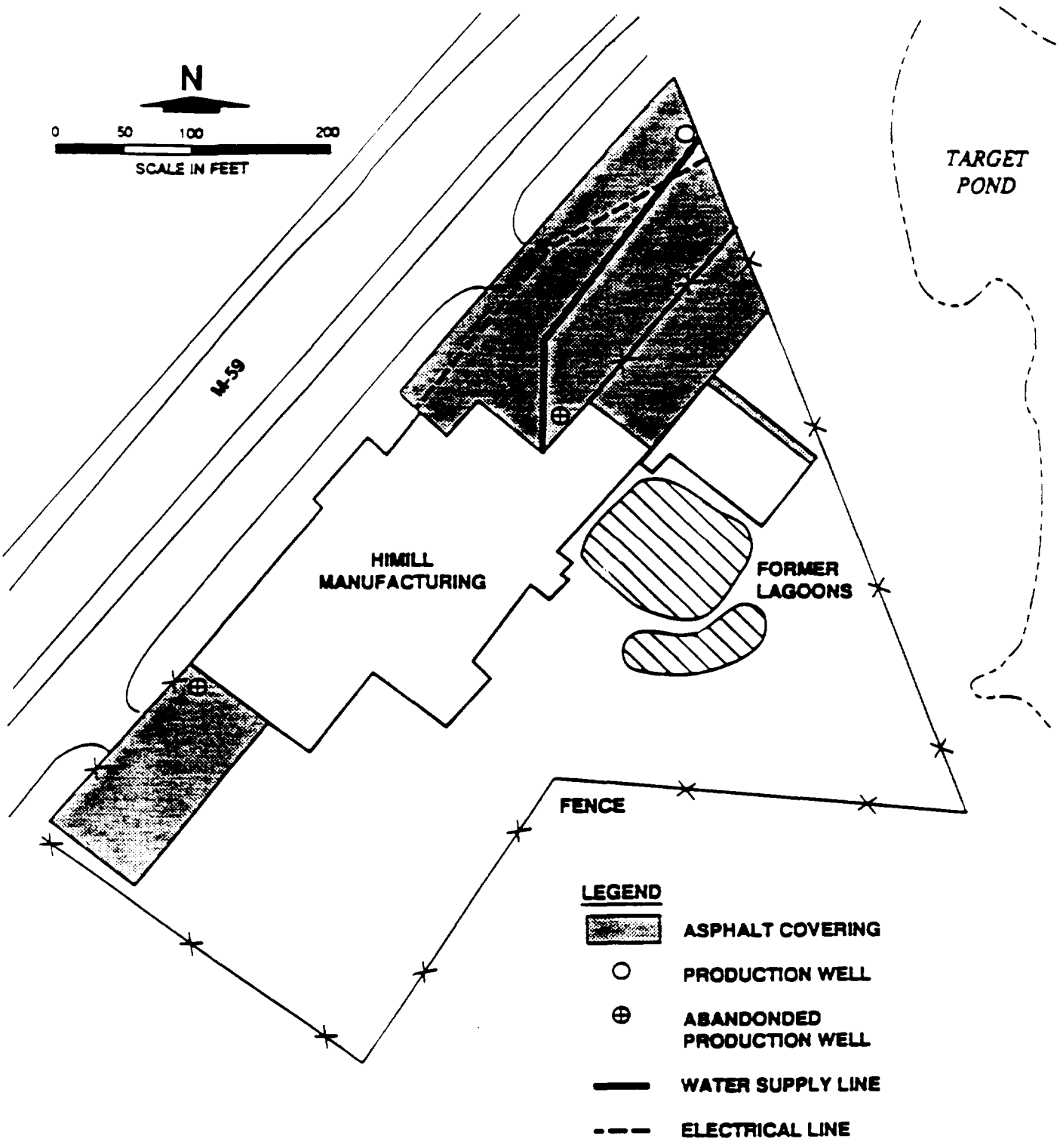
Based on the Hi-Mill site operations, the chemicals expected to be of potential concern at the site are the volatile organics that are used in degreasing operations and their degradation products and inorganic chemicals used in fabrication processes. The contaminant pathways of potential concern are surface runoff from contaminated soil and migration of contaminants into and through the groundwater.



SOURCE: USGS 7.5 Minute Topographic Map, HIGHLAND, MICHIGAN Quadrangle, 1983

Adapted from Geraghty & Miller 1990.

FIGURE 1-1 LOCATION OF HI-MILL SITE



Adapted from Geraghty & Miller 1990.

FIGURE 1-2 OVERVIEW OF THE HI-MILL SITE

1.3 Scope of This Risk Assessment

This human health evaluation evaluates the potential risk to humans, both now and in the future, associated with the contaminants at the Hi-Mill site. Risks to environmental species are evaluated in a separate Ecological Assessment (Life Systems 1992).

1.4 Organization of This Report

In addition to this Introduction, this Baseline Risk Assessment - Human Health Evaluation Report consists of the following sections:

2.0 Identification of Chemicals of Potential Concern
3.0 Exposure Assessment
4.0 Toxicity Assessment
5.0 Risk Characterization
6.0 Assessment of Uncertainties
7.0 Summary
8.0 References

This report also contains six appendices. Appendix 1 presents the calculations for Exposure Point Concentration (EPC) calculations. Appendix 2 presents a detailed description of the models used to calculate air concentrations of Volatile Organic Compounds (VOCs) released from soil. Appendix 3 presents a detailed description and calculation of Human Intake Factors (HIFs). Appendix 4 contains expanded toxicological summaries for those chemicals of chief health concern at this site. Appendix 5 contains computer worksheets of risk calculations. Appendix 6 presents a summary of the sampling data for this site.

2.0 IDENTIFICATION OF CHEMICALS OF POTENTIAL CONCERN

Chemicals of potential concern are chemicals present at a site that could pose a risk of adverse health effects to exposed humans. The selection of these chemicals is based mainly on the results of chemical analyses of environmental media from the site. Chemicals of potential concern normally include all toxic chemicals that have been released by former plant operations and waste disposal activities at the site, but may also include naturally-occurring toxic chemicals and toxic chemicals that have reached the site by environmental transport from other sources. If the risk assessment indicates that one or more of these chemicals poses sufficient risk to be of concern, then more detailed evaluations of the relative magnitude of the risks from each source (on-site activities, naturally-occurring chemicals, chemicals transported from other sources) may be needed to provide the basis for evaluation of remedial alternatives and other risk management decisions.

A summary of the analytical data available for the Hi-Mill site and a description of the procedures used to identify chemicals of potential concern from these data are presented below.

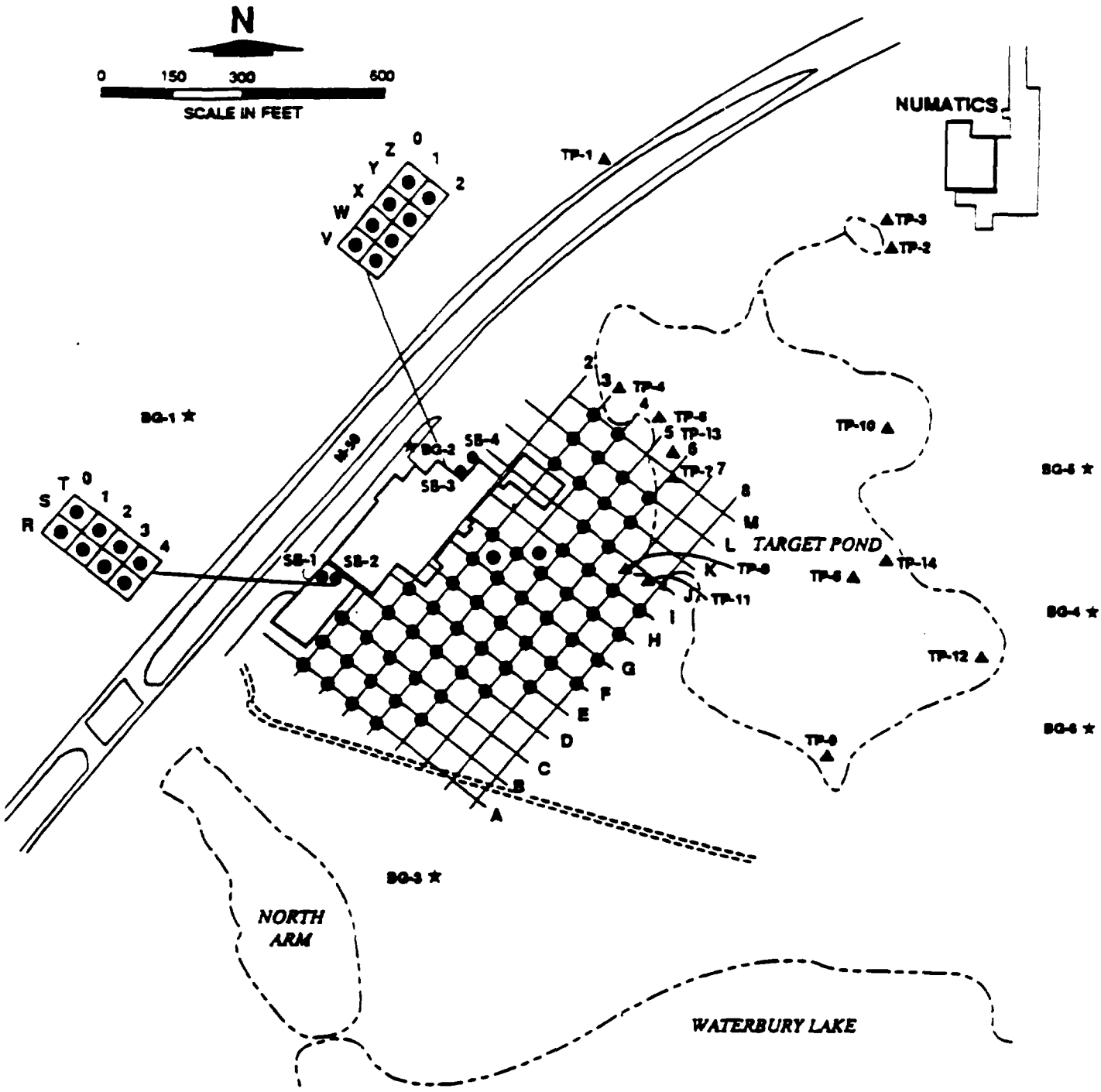
2.1 Summary of Available Data

Remedial Investigation field activities were conducted at the Hi-Mill site by Techna Corporation from January 29 to March 29, 1990 (Phase I) (Techna Corporation 1990). In order to strengthen the database for risk assessment and to further characterize the nature and extent of contamination at the site, a second round of sampling (Phase II) was performed by Geraghty and Miller from November 21, 1991 to February 19, 1992 (Geraghty and Miller 1992a). Samples of soil, surface water, groundwater and sediments were collected on and near the site and analyzed for compounds on USEPA's Target Compound List (TCL) and Target Analyte List (TAL) according to USEPA Contract Laboratory Program (CLP) protocols (USEPA 1988a,b). A summary of the sampling and analysis performed during Phase I and Phase II is provided below. The sampling locations are identified in Figures 2-1 and 2-2.

2.1.1 Phase I Data

Soil

A total of 271 soil samples were collected from on-site locations. These included both surface (0 to 1 foot deep) and subsurface (1.5 to 16.5 feet deep) samples and were collected from soil borings and monitoring wells dug in the areas beneath the parking lots north and south of the Hi-Mill buildings and the area behind the buildings. Analyses for "short list" metals (metals selected by Techna (1990) expected to be present based on Hi-Mill site activities; aluminum, chromium, copper, nickel, silver and zinc) were performed on 176 samples, including 15 field duplicates. Twenty-six samples, including 2 field duplicates, were analyzed for all TAL chemicals; 54 samples, including 5 field duplicates, were analyzed for TCL volatile compounds and 15 samples, including 2 field duplicates were analyzed for TCL semivolatiles. Ten background soil samples were collected and analyzed for TAL chemicals and TCL compounds.



LEGEND

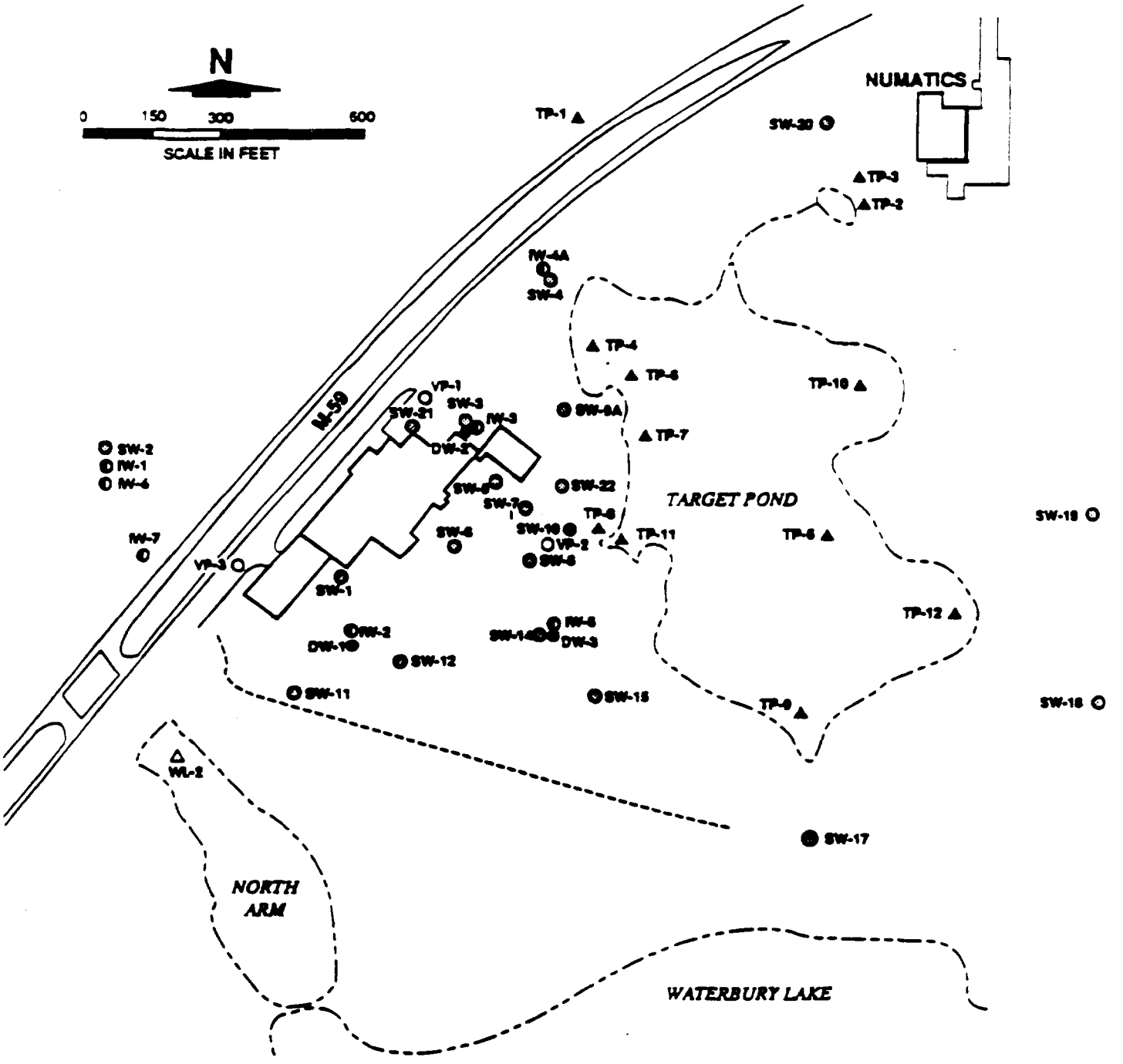
BG-1 ★ BACKGROUND SOIL

TP-1 ▲ TARGET WETLANDS (POND) SEDIMENT

● SOIL BORING

Adapted from Geraghty & Miller 1990.

FIGURE 2-1 SOIL AND SEDIMENT SAMPLING LOCATIONS



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⊙ SW-1	SHALLOW MONITORING WELL	▲ TP-1	TARGET WETLAND (POND)
◐ IW-1	INTERMEDIATE MONITORING WELL	○ VP-1	VERTICAL PROFILE BORING
● DW-1	DEEP MONITORING WELL	△ WL-2	WATERBURY LAKE

Adapted from Geraghty & Miller 1990.

FIGURE 2-2 GROUNDWATER AND SURFACE WATER SAMPLING LOCATIONS

Groundwater

Groundwater samples were collected from 31 monitoring wells on and near the site. All samples were analyzed for dissolved short list metals and 8 samples, including 1 field duplicate, were analyzed for dissolved TAL metals. Twenty-nine samples, including 3 field duplicates, were analyzed for TCL volatiles; 5 samples, including 1 field duplicate, were analyzed for TCL semivolatiles; and 30 samples, including 3 field duplicates were analyzed for ammonia-nitrogen and nitrate + nitrite.

Surface Water

Eleven surface water samples were collected from Target Pond and two samples were collected from Waterbury Lake. Four background samples were collected from a nearby pond. Samples were analyzed for the short list metals and chromium VI. Five samples were analyzed for all TAL chemicals and nine were analyzed for ammonia-nitrogen and nitrate + nitrite.

Sediments

Twenty-four sediment samples were collected, twenty-one from Target Pond and three from Waterbury Lake. In addition, four background sediment samples were collected from a nearby pond. Samples were analyzed for the short list metals and chromium VI. Five samples were analyzed for all TAL chemicals.

2.1.2 Phase II Data

Field Gas Chromatography (GC) analyses of soil and groundwater samples from around the Hi-Mill plant were performed during the Phase II investigation. The data generated by these analyses were used for screening purposes and were not used for quantitative evaluations in the risk assessment. Only samples of environmental media analyzed in accordance with CLP protocols are described below.

Soil

Twelve subsurface (7.5 to 117 feet deep) soil samples were collected from soil borings and monitoring wells and analyzed for TAL chemicals and TCL volatiles.

Groundwater

Thirty-four groundwater samples were collected from monitoring wells on and near the Hi-Mill site and analyzed for TCL volatiles. Thirty of these samples were analyzed for TAL dissolved metals, and six of these samples were also analyzed for total metals.

Sediments

Four sediment samples from Target Pond and two from Waterbury Lake were analyzed for all TAL chemicals except cyanide.

Surface Water

No surface water samples were collected for chemical analysis during Phase II investigations.

2.2 Data Quality Evaluation

During the RI investigations numerous environmental samples were analyzed by field GC. Only data generated by laboratories following CLP or CLP-equivalent protocols were used for quantitative evaluations in the risk assessment. Field GC data were used only for qualitative assessment.

The data from both Phases were validated by Geraghty and Miller according to guidance provided by USEPA (1988c, 1988d). Data were qualified either by the laboratory or by the validator according to USEPA guidance, and data were used in the RA as follows:

Data which were considered unreliable due to quality control problems were qualified with an "R" and were not used in the risk assessment.

Chemicals which were analyzed for but were not detected were qualified with a "U." The "U" qualifier represents the Contract Required Quantitation Limit (CRQL) or Contract Required Detection Limit (CRDL) adjusted for any sample matrix or preparation requirements for analysis. In addition, samples associated with contaminated blanks were "U" qualified, if the concentration in the sample was less than 10 times the blank concentration for common laboratory contaminants (methylene chloride, acetone, 2-butanone), or less than 5 times the blank concentration for other chemicals, in accordance with USEPA (1991b) guidance. These values were used in the risk assessment as nondetects.

Any detected value for an organic chemical which was detected at greater than 10 times or 5 times the concentration in the associated blank was qualified with a "B." These values were used in the risk assessment as if they were unqualified.

Any sample values with minor deviations from CLP requirements for holding times, analytical spikes, duplicates or other quality control parameters were considered estimated values and were coded with a "J." Sample values less than the CRQL were also "J" qualified. These values were used in the risk assessment as if they were unqualified, as recommended by USEPA (1989a).

Any detected value for an inorganic chemical reported as less than the CRDL but greater than the Instrument Detection Limit (IDL) was qualified with a "B." These values were used in the risk assessment as if they were unqualified.

2.3 Selection of Chemicals of Potential Concern

Chemicals of potential concern are those chemicals that are included in the risk assessment. It is assumed that all chemicals analyzed for are chemicals of potential concern, unless they are eliminated for a specific reason. The Hi-Mill monitoring data were evaluated to form the list of chemicals of potential concern for characterizing risks at the site. During this evaluation a number of chemicals were eliminated for various reasons (USEPA 1989a). The remaining chemicals are the chemicals of potential concern for the Hi-Mill site. The approach used to identify the chemicals of potential concern is described below.

2.3.1 Chemicals Never Detected

Any chemical which was never detected in any medium sampled at Hi-Mill (i.e., qualified by a "U" in every sample) was eliminated from consideration as a chemical of potential concern, since there is no evidence that the chemical is present in these media. The chemicals eliminated because they were not detected are listed in Table 2-1.

As indicated in Table 2-1, chromium VI was eliminated as a chemical of potential concern. The two main valence states of chromium, Cr^{+3} and Cr^{+6}, are in dynamic equilibrium in the natural environment. Therefore, because Cr^{+6} was not detected in surface water or sediments at a particular time does not mean that chromium VI will never be present in these media. Furthermore, total chromium was detected in all media and Cr^{+6} was not specifically analyzed for in groundwater or soil. Thus, total chromium, including both Cr^{+3} and Cr^{+6}, was retained as a chemical of potential concern.

Exclusion of a chemical because it was never detected introduces some uncertainty into the risk assessment. This is especially true if the analytical detection limit for the chemical was sufficiently high (i.e., insensitive) that a health risk might occur from chemicals present on-site at environmental levels equal to or less than the detection limit. The uncertainty introduced by exclusion of never-detected chemicals is discussed in Section 6.2.

2.3.2 Beneficial Nutrients

A number of the inorganic chemicals detected on-site are naturally-occurring components of the human body, and daily intakes of moderate levels of these nutrients are considered beneficial or essential for good health (NRC 1989). Chemicals in this group include calcium, copper, iron, magnesium, manganese, potassium, selenium, sodium and zinc. In order to judge whether any of these chemicals could be eliminated as chemicals of potential concern, a dose was calculated that would result from ingestion of groundwater and soil, assuming the same residential intake levels as detailed in Section 3. As shown in Table 2-2, the calculated daily intake of each of these chemicals is within the beneficial range of the Recommended Dietary Allowance (RDA) (NRC 1989). Therefore, exposure to these chemicals from soil and groundwater at the site is not expected to be of concern. Daily intakes were also compared to available reference doses (RfDs) derived by USEPA (1992a; 1991e). The comparison indicates that the intake of copper, manganese, selenium and zinc is well below the toxic level. However, copper was detected in Target Pond sediments at relatively high concentrations during Phase II sampling (Geraghty and Miller 1992b), and exposure to copper in sediments could be of concern. Therefore, copper was retained as a chemical of potential concern for the Hi-Mill site.

2.3.3 Tentatively Identified Compounds

Several Tentatively Identified Compounds (TICs) were reported in samples from Hi-Mill media. These included alkanes, organic acids and other organics (Geraghty and Miller 1990). These TICs were evaluated qualitatively as an uncertainty in the risk assessment.

TABLE 2-1 CHEMICALS NEVER DETECTED IN ANY MEDIUM AT HI-MILL

Chemical Name	Chemical Name	Chemical Name
Acenaphthene	Chloronaphthalene, 2-	Fluoranthene
Acenaphthylene	Chlorophenol, 2-	Fluorene
Aldrin	Chlorophenyl-phenylether, 4-	Gamma Chlordane
Alpha Chlordane	Chromium (VI)	Gamma-BHC
Alpha-BHC	Chrysene	Heptachlor
Anthracene	DDD, 4,4-	Heptachlor epoxide
Aroclor-1016	DDE, 4,4-	Hexachlorobenzene
Aroclor-1221	DDT, 4,4-	Hexachlorobutadiene
Aroclor-1232	Delta-BHC	Hexachlorocyclopentadiene
Aroclor-1242	Di-n-octylphthalate	Hexachloroethane
Aroclor-1248	Dibenz(a,h)anthracene	Hexanone, 2-
Aroclor-1254	Dibenzofuran	Indeno(1,2,3-cd)pyrene
Aroclor-1260	Dibromochloromethane	Isophorone
enzene	Dichlorobenzene, 1,2-	Methoxychlor
Benzo(a)anthracene	Dichlorobenzene, 1,3-	Methylnaphthalene, 2-
Benzo(a)pyrene	Dichlorobenzene, 1,4-	Methylphenol, 2-
Benzo(b)fluoranthene	Dichlorobenzidine, 3,3'-	Methylphenol, 4-
Benzo(g,h,i)perylene	Dichloroethane, 1,2-	N-Nitroso-di-n-propylamine
Benzo(k)fluoranthene	Dichloroethene, 1,1-	N-Nitrosodiphenylamine
Benzoic acid	Dichlorophenol, 2,4-	Naphthalene
enzyl alcohol	Dichloropropane, 1,2-	Nitroaniline, 2-
a-BHC	Dichloropropene, cis-1,3-	Nitroaniline, 3-
(2-chloroethoxy)methane	Dichloropropene, trans-1,3-	Nitroaniline, 4-
Bis(2-chloroethyl)ether	Dieldrin	Nitrobenzene
Bis(2-chloroisopropyl)ether	Diethylphthalate	Nitrophenol, 2-
Bromoform	Dimethylphenol, 2,4-	Nitrophenol, 4-
Bromomethane	Dimethylphthalate	Pentachlorophenol
Bromophenyl-phenylether, 4-	Dinitro-2-methylphenol, 4,6-	Phenanthrene
Butylbenzylphthalate	Dinitrophenol, 2,4-	Phenol
Carbon disulfide	Dinitrotoluene, 2,4-	Pyrene
rbon tetrachloride	Dinitrotoluene, 2,6-	Styrene
nloro-3-methylphenol	Endosulfan I	Thallium
Chloroaniline, 4-	Endosulfan II	Toxaphene
Chloroethane	Endosulfan sulfate	Trichlorobenzene, 1,2,4-
Chloroethyl vinyl ether, 2-	Endrin	Trichlorophenol, 2,4,5-
Chloromethane	Endrin ketone	Trichlorophenol, 2,4,6-

TABLE 2-2 EVALUATION OF CHEMICALS THAT ARE BENEFICIAL NUTRIENTS

Chemical	Conc. in Soil[a]	DI from Soil[b]	Conc. in Water[c]	DI from Water[d]	Total DI mg/day	Health Criteria RDA[e], mg/day	Health Criteria RfD[f], mg/day	Ratio (DI/RDA)	Ratio (DI/RfD)
Calcium	39,000	4.68	240	480	485	1,200	--	0.40	--
Copper	280	0.0336	0.042	0.084	0.118	3	2.6	0.04	0.045
Iron	21,000	2.52	3.9	7.8	10.3	30	--	0.34	--
Magnesium	11,000	1.32	150	300	301	400	--	0.75	--
Manganese	470	0.0564	0.69	1.38	1.4	5	7	0.29	0.21
Potassium	1,400	0.168	4.6	9.2	9	2,000	--	0.00	--
Selenium	--[g]	0	0.0011	0.0022	0.0022	0.075	0.4	0.03	0.0055
Sodium	349	0.04188	140	280	280	500	--	0.56	--
Zinc	81	0.00972	0.095	0.19	0.200	19	14	0.01	0.014

(a) Upper 95th Confidence Limit of the arithmetic mean of all surface and subsurface soil samples (mg/kg).
(b) Assumed ingestion of 120 mg (1.2E-04 kg) soil/day.
(c) Upper 95th Confidence Limit of the arithmetic mean of all groundwater samples (mg/L).
(d) Assumed ingestion of 2 L/day.
(e) Recommended Dietary Allowance (NRC 1989).
(f) Reference dose from USEPA (1992a) or USEPA (1991e), assuming a 70-kg body weight.
(g) Chemical not detected in this medium.

2.3.4 Comparison to Background

Some of the chemicals detected on-site occur naturally in soil, water and sediments and may not be related to site activities. However, these chemicals were not eliminated as chemicals of potential concern since some of them could contribute to the overall risk from the site. An analysis of the contribution of background chemicals to the total risk is presented in Section 5.3. A summary of the concentrations of chemicals in background samples is presented in Appendix 6.

2.3.5 Comparison to Blanks

Blank comparisons were made by Geraghty and Miller (1990; 1992a) as described in Section 2.2. These comparisons were incorporated into the database by Life Systems. Any samples which were associated with contaminated blanks were appropriately "U" qualified in accordance with USEPA (1988c, 1991b) guidance. Thus, common laboratory contaminants were retained as contaminants of potential concern only if the concentration in one or more samples exceeded ten times the concentration in any associated blank. Other contaminants which were detected in both samples and blanks were retained only if the concentration in one or more samples was greater than five times the concentration in any associated blank. Many samples were "U" qualified, but no chemicals were eliminated from the risk assessment as a result of this analysis.

2.3.6 Frequency of Detection

A number of chemicals were detected only once or twice out of all the on-site samples that were analyzed. These infrequently detected chemicals may be artifacts in the data due to sampling, analytical, or other problems, or they may be present on-site at very low levels that can be detected only infrequently. Some of these chemicals may have been used at or near the site and may be associated with site activities. In view of this, a conservative approach was adopted and these chemicals were retained as chemicals of potential concern. Uncertainties due to including these chemicals in the quantitative risk assessment are addressed in Section 6.3.

2.3.7 List of Chemicals of Potential Concern

After excluding chemicals never detected and beneficial nutrients, 38 chemicals remained as chemicals of potential concern. A summary of the analytical data on these chemicals is presented in Table 2-3, including frequency of detection and range of concentrations in surface soil, subsurface soil, groundwater, surface water and sediment. The risk assessment is focused on these contaminants.

TABLE 2-3 SUMMARY OF CHEMICALS OF POTENTIAL CONCERN AT THE HI-MILL SITE

Chemical Name	Surface Soil: Freq. of Detection Hits	Surface Soil: Freq. of Detection Total	Surface Soil: Range of Detects, mg/kg Min.	Surface Soil: Range of Detects, mg/kg Max.	Surface Soil: Range of Detection Limits, mg/kg Min.	Surface Soil: Range of Detection Limits, mg/kg Max.	Subsurface Soil: Freq. of Detection Hits	Subsurface Soil: Freq. of Detection Total	Subsurface Soil: Range of Detects, mg/kg Min.	Subsurface Soil: Range of Detects, mg/kg Max.	Subsurface Soil: Range of Detection Limits, mg/kg Min.	Subsurface Soil: Range of Detection Limits, mg/kg Max.
Inorganics												
Aluminum	79	79	2.1E+03	2.7E+04			106	106	1.7E+03	2.7E+04		
Antimony	1	8	1.7E+01	1.7E+01	1.3E+01	1.3E+02	1	6	9.7E+00	9.7E+00	1.2E+01	1.3E+01
Arsenic	8	8	3.2E+00	1.4E+01			6	6	2.3E+00	6.2E+00		
Barium	7	8	3.0E+01	1.3E+02	1.1E+02	1.1E+02	6	6	7.5E+00	1.4E+02		
Beryllium	6	8	3.4E-01	1.2E+00	2.9E-01	2.5E+00	5	6	2.7E-01	8.6E-01	1.2E-01	1.2E-01
Cadmium	7	8	8.0E-01	1.1E+01	6.3E-01	6.3E-01	5	6	5.9E-01	1.3E+00	5.0E-01	5.0E-01
Chromium	79	79	4.5E+00	4.4E+03			106	106	4.6E+00	1.6E+03		
Cobalt	6	8	4.8E+00	1.5E+01	4.5E+00	3.5E+01	6	6	3.2E+00	1.2E+01		
Copper	69	79	2.3E+00	5.0E+03	2.3E+00	3.6E+00	91	106	2.4E+00	4.4E+03	2.2E+00	2.6E+00
Lead	8	8	1.5E+01	6.0E+01			6	6	6.2E+00	2.3E+01		
Mercury	0	8			1.0E-01	8.6E-01	1	7	9.0E-02	9.0E-02	4.5E-02	1.3E-01
Nickel	77	78	5.0E+00	5.0E+01	2.8E+01	2.8E+01	106	106	4.9E+00	4.2E+01		
Silver	0	79			1.0E+00	2.3E+01	3	106	1.2E+00	1.3E+01	9.4E-01	2.9E+00
Vanadium	7	8	1.6E+01	5.2E+01	2.0E+01	2.0E+01	6	6	9.4E+00	3.6E+01		
Cyanide	0	8			6.4E-01	6.3E+00	0	6			3.0E-01	6.4E-01
Ammonia-N		NA[a]						NA				
Nitrate + Nitrite		NA						NA				
Volatiles												
Acetone	0	14			1.1E-02	1.4E-01	2	48	1.4E-02	2.4E-02	5.5E-03	1.5E-01
Bromodichloromethane	0	14			5.0E-03	6.0E-03	0	48			3.0E-03	3.1E-02
Butanone, 2-	0	14			1.1E-02	1.2E-02	0	48			5.5E-03	6.2E-02
Chlorobenzene	0	14			5.0E-03	6.0E-03	3	48	2.5E-03	1.4E-02	3.0E-03	3.1E-02
Chloroform	0	14			5.0E-03	6.0E-03	0	48			3.0E-03	3.1E-02
Dichloroethane,1,1-	0	14			5.0E-03	6.0E-03	0	48			3.0E-03	3.1E-02
Dichloroethene,1,2-(total)	0	14			5.0E-03	3.6E-02	12	48	2.0E-03	1.3E-01	3.0E-03	3.1E-02
Ethylbenzene	0	14			5.0E-03	6.0E-03	2	48	2.0E-03	2.5E-03	3.0E-03	3.1E-02
Methyl-2-pentanone,4-	0	14			1.1E-02	1.2E-02	1	48	5.0E-03	5.0E-03	5.5E-03	6.2E-02
Methylene chloride	0	14			6.0E-03	1.4E-02	1	48	5.1E-03	5.1E-03	3.0E-03	4.6E-02
Tetrachloroethane,1,1,2,2-	0	14			5.0E-03	6.0E-03	1	48	2.8E-03	2.8E-03	3.0E-03	3.1E-02
Tetrachloroethene	0	14			5.0E-03	6.0E-03	2	48	6.8E-02	2.3E-01	3.0E-03	6.9E-03
Toluene	1	14	1.4E-01	1.4E-01	6.0E-03	9.0E-03	9	48	2.2E-03	3.7E-02	3.0E-03	3.1E-02
Trichloroethane,1,1,1-	1	14	2.0E-03	2.0E-03	5.0E-03	6.0E-03	4	48	1.0E-03	1.1E-02	3.0E-03	3.1E-02
Trichloroethane,1,1,2-	0	14			5.0E-03	6.0E-03	1	48	2.8E-03	2.8E-03	3.0E-03	3.1E-02
Trichloroethene	11	14	2.0E-03	4.3E-02	6.0E-03	6.0E-03	31	48	1.0E-03	6.1E+00	3.0E-03	6.3E-03
Vinyl acetate	0	14			1.1E-02	1.2E-02	0	48			5.5E-03	6.2E-02
Vinyl chloride	0	14			1.1E-02	1.2E-02	0	48			5.5E-03	6.2E-02
Xylenes(total)	0	14			5.0E-03	6.0E-03	3	49	2.0E-03	2.0E-03	2.0E-03	3.1E-02
Semivolatiles												
Bis(2-ethylhexyl)phthalate		NA					2	3	2.1E-01	2.9E-01	3.9E-01	3.9E-01
Di-n-butylphthalate		NA					1	3	1.2E-01	1.2E-01	3.9E-01	4.3E-01

continued

(a) NA = Chemical not analyzed for in this medium.

Table 2-3 - continued

Chemical Name	Surface Water: Freq. of Detection Hits	Surface Water: Freq. of Detection Total	Surface Water: Range of Detects, mg/L Min.	Surface Water: Range of Detects, mg/L Max.	Surface Water: Range of Detection Limits, mg/L Min.	Surface Water: Range of Detection Limits, mg/L Max.	Sediment: Freq. of Detection Hits	Sediment: Freq. of Detection Total	Sediment: Range of Detects, mg/kg Min.	Sediment: Range of Detects, mg/kg Max.	Sediment: Range of Detection Limits, mg/kg Min.	Sediment: Range of Detection Limits, mg/kg Max.
Inorganics												
Aluminum	1	9	5.4E+00	5.4E+00	4.3E-02	8.5E-02	25	25	1.4E+03	3.4E+04		
Antimony	0	3			2.6E-02	5.1E-02	0	9			6.3E+00	6.2E+01
Arsenic	0	3			1.5E-03	3.0E-03	9	9	1.2E+00	9.5E+00		
Barium	0	3			2.1E-02	4.2E-02	9	9	4.6E+01	2.7E+02		
Beryllium	0	3			5.0E-04	1.0E-03	4	9	6.7E-01	1.9E+00	7.7E-01	3.3E+00
Cadmium	0	3			1.0E-03	2.0E-03	4	9	1.5E+00	6.0E+00	3.1E+00	1.3E+01
Chromium	2	9	6.4E-03	1.4E-02	3.5E-03	2.9E-02	24	25	1.7E+01	2.4E+03	7.3E+00	7.3E+00
Cobalt	0	3			7.0E-03	1.4E-02	6	9	5.5E+00	1.2E+01	8.2E+00	1.3E+01
Copper	0	9			5.0E-03	1.3E-02	23	25	6.4E+00	1.7E+04	2.8E+00	1.0E+01
Lead	2	3	3.1E-03	4.3E-03	2.0E-03	2.0E-03	9	9	1.1E+01	1.4E+02		
Mercury	0	3			1.0E-04	2.0E-04	1	9	7.3E-01	7.3E-01	5.3E-02	1.6E+00
Nickel	5	9	1.4E-01	3.0E-01	5.5E-03	1.2E-01	24	25	7.3E+00	4.2E+01	2.2E+01	2.2E+01
Silver	3	9	6.8E-03	1.1E-02	4.5E-03	9.0E-03	2	25	4.8E+00	9.6E+00	1.1E+00	1.8E+01
Vanadium	0	3			4.0E-03	8.0E-03	8	9	1.5E+01	4.4E+01	1.3E+01	1.3E+01
Cyanide	0	4			1.0E-02	1.0E-02	0	3			3.1E-01	9.6E-01
Ammonia-N		NA						NA				
Nitrate + Nitrite	0	2			2.5E-02	5.0E-02		NA				
Volatiles												
Acetone		NA						NA				
Bromodichloromethane		NA						NA				
Butanone, 2-		NA						NA				
Chlorobenzene		NA						NA				
Chloroform		NA						NA				
Dichloroethane, 1,1-		NA						NA				
Dichloroethene, 1,2- (total)		NA						NA				
Ethylbenzene		NA						NA				
Methyl-2-pentanone, 4-		NA						NA				
Methylene chloride		NA						NA				
Tetrachloroethane, 1,1,2,2-		NA						NA				
Tetrachloroethene		NA						NA				
Toluene		NA						NA				
Trichloroethane, 1,1,1-		NA						NA				
Trichloroethane, 1,1,2-		NA						NA				
Trichloroethene		NA						NA				
Vinyl acetate		NA						NA				
Vinyl chloride		NA						NA				
Xylenes (total)		NA						NA				
Semivolatiles												
Bis(2-ethylhexyl)phthalate		NA						NA				
Di-n-butylphthalate		NA						NA				

continued

Table 2-3 - continued

Chemical Name	Groundwater					
	Freq. of Detection		Range of Detects, mg/L		Range of Detection Limits, mg/L	
	Hits	Total	Min.	Max.	Min.	Max.
Inorganics						
Aluminum	14	68	5.9E-02	2.3E+02	2.8E-02	1.1E-01
Antimony	1	15	4.4E-02	4.4E-02	2.2E-02	5.6E-02
Arsenic	3	15	4.2E-03	1.0E-02	5.0E-04	3.0E-03
Barium	10	15	2.2E-02	8.7E-02	2.3E-02	4.2E-02
Beryllium	1	15	1.0E-03	1.0E-03	5.0E-04	2.0E-03
Cadmium	0	15			1.0E-03	4.0E-03
Chromium	9	68	5.8E-03	5.5E-01	3.1E-03	3.0E-02
Cobalt	3	15	7.3E-03	2.3E-02	2.0E-03	1.4E-02
Copper	11	68	5.2E-03	7.5E-01	2.4E-03	3.4E-02
Lead	2	15	2.5E-03	1.1E-02	7.0E-04	3.2E-03
Mercury	2	15	2.0E-04	3.6E-04	1.0E-04	2.0E-04
Nickel	25	68	1.0E-02	6.7E-01	5.5E-03	1.9E-02
Silver	1	68	1.5E-02	1.5E-02	3.3E-03	9.0E-02
Vanadium	4	15	7.9E-03	2.2E-02	2.5E-03	8.0E-03
Cyanide	1	7	3.7E-02	3.7E-02	5.0E-03	1.0E-02
Ammonia-N	17	24	5.0E-02	2.2E+00	5.0E-02	5.0E-02
Nitrate + Nitrite	13	24	5.0E-02	1.6E+01	5.0E-02	5.0E-02
Volatiles						
Acetone	7	56	2.0E-03	5.8E-02	5.0E-03	5.0E-01
Bromodichloromethane	1	56	1.0E-03	1.0E-03	2.5E-03	5.0E-01
Butanone, 2-	1	56	2.8E-02	2.8E-02	5.0E-03	5.0E-01
Chlorobenzene	0	56			2.5E-03	5.0E-01
Chloroform	1	56	2.0E-03	2.0E-03	2.5E-03	5.0E-01
Dichloroethane, 1,1-	1	56	2.0E-03	2.0E-03	2.5E-03	5.0E-01
Dichloroethene, 1,2- (total)	12	56	2.0E-03	1.4E+00	2.5E-03	1.0E-02
Ethylbenzene	0	56			2.5E-03	5.0E-01
Methyl-2-pentanone, 4-	1	56	1.0E-03	1.0E-03	5.0E-03	5.0E-01
Methylene chloride	0	56			5.0E-03	5.0E-01
Tetrachloroethane, 1,1,2,2-	0	56			2.5E-03	5.0E-01
Tetrachloroethene	0	56			2.5E-03	5.0E-01
Toluene	2	56	2.0E-03	3.0E-03	2.5E-03	5.0E-01
Trichloroethane, 1,1,1-	2	56	1.0E-03	1.0E-01	2.5E-03	5.0E-02
Trichloroethane, 1,1,2-	0	56			2.5E-03	5.0E-01
Trichloroethene	12	56	2.0E-03	6.7E+00	2.5E-03	1.0E-02
Vinyl acetate	1	47	1.0E-02	1.0E-02	5.0E-03	5.0E-01
Vinyl chloride	3	56	3.5E-03	6.8E-02	5.0E-03	5.0E-01
Xylenes(total)	1	56	3.0E-03	3.0E-03	2.5E-03	5.0E-01
Semivolatiles						
Bis(2-ethylhexyl)phthalate	0	3			5.0E-03	1.0E-02
Di-n-butylphthalate	1	3	6.5E-03	6.5E-03	1.0E-02	1.0E-02

3.0 EXPOSURE ASSESSMENT

Exposure is defined as contact between a human and a chemical in the environment. The amount of contact (the intake) depends upon the level of chemical in the environment and the extent of contact between humans and the contaminated environmental media (air, soil, water, etc.). This section describes the circumstances under which humans may be exposed to chemicals of potential concern at this site, and provides quantitative estimates of intakes for the most important pathways.

3.1 Characteristics of the Exposure Setting

Details of the Hi-Mill site have been provided in the RI report (Geraghty and Miller 1992a). Some of this information is directly applicable in describing human exposure to the contaminants of potential concern and is summarized below.

3.1.1 Climate and Meteorology

Highland Township has the warm summers and cold winters characteristic of lower Michigan. Based on climatological data for 1987 through 1990, the annual average temperature is about 50 F. February is usually the coldest month (average temperature about 25 F) and July the warmest (average temperature about 75 F). The annual precipitation averages about 33 inches.

3.1.2 Surface Water and Groundwater

Target Pond (sometimes referred to as Target Wetland or Marsh), Waterbury Lake and the North Arm of Waterbury Lake are the surface water bodies closest to the Hi-Mill facility. Target Pond is an area of about 8 to 10 acres just east of the site with a maximum depth of about four feet. Waterbury Lake occupies about 35 to 40 acres approximately 1,000 feet south of the site. The North Arm of Waterbury Lake, just southwest of the site, is isolated from the main body of the Lake.

A hydrogeologic survey has identified three groundwater flow regimes, a shallow perched aquifer, an intermediate aquifer and a deep aquifer. There does not appear to be communication between the shallow and intermediate aquifers, but this information has not yet been confirmed. Flow in the shallow perched aquifer appears to be radial from the Hi-Mill facility with a preferential flow to the west-southwest. Flow direction is to the west in the intermediate aquifer and southeast in the deep aquifer.

3.1.3 Vegetation

The Hi-Mill building and paved parking areas occupy most of the site. The remainder of the property is almost completely vegetated. Highland Road (Highway M-59) borders the site to the northwest. All other areas surrounding the site are either buildings, water bodies or almost completely vegetated.

3.1.4 Land Use

The site is located in a rural/suburban area about 20 miles from Pontiac, Michigan. Current land use in the immediate vicinity of the site is industrial, residential and recreational. An industrial facility, Numatics,

Inc., is located about 1,000 feet northeast of the site. The Highland State Recreational Area occupies the remaining surrounding land not occupied by residences or the highway.

3.2 Potentially Exposed Populations

Current Site Conditions

Under current site conditions, there are workers at the Hi-Mill plant, but no on-site residents. The closest residences to the site are about 1,000 feet east along Waterbury Road and 2,100 feet southwest along Highway M-59. Residents might be exposed to site contaminants in surface water or sediments off site, but these exposures are expected to be brief and sporadic. Groundwater wells used for drinking water by the nearby residents have been sampled by the Michigan Department of Public Health (MDPH) and found not to be contaminated (Techna Corporation 1990). Hunters and other visitors to the Michigan State Recreation Area may come into contact with site contaminants in surface water or sediments near the site, but these exposures are also expected to be brief and sporadic. Therefore, the on-site worker is the most likely exposed individual under current conditions.

Future Site Conditions

In the future, it is possible the site might remain an industrial facility or be developed for residential use. While continued industrial use is likely, based on current zoning in the area, the current residences nearby on Waterbury Road and Highland Road (Highway M-59) and discussion with Highland township personnel, residential development of the site is a reasonable possibility. Therefore, this assessment evaluates a future hypothetical on-site resident.

3.3 Exposure Pathway Analysis

An exposure pathway describes the movement of a chemical from a source to the point where an individual comes in contact with that chemical. A complete exposure pathway consists of the following:

- A source and mechanism of chemical release
- A transport medium
- A point of potential human contact with the contaminated medium
- An exposure route at the contact point
- A potentially exposed population

If a pathway is not complete there is no exposure and risk cannot be characterized. The information gathered by Techna, Geraghty and Miller, SEC Donohue and Life Systems personnel for the Hi-Mill site was evaluated to determine which pathways are complete. Figure 3-1 presents a conceptual site model which shows how contaminants at the Hi-Mill site might come into contact with the populations described above. The pathways, and the likely significance of each, are evaluated below.

3.3.1 Contaminant Fate and Transport

Contaminant migration may occur from movement of leachate or particulate matter from surface or subsurface soil into groundwater. Contaminants in groundwater may be discharged into the surface water of Target Pond and may partition to the sediments. Contaminants may enter the surface water through runoff from surface soil. Particulates in surface water may settle to the sediments and adsorbed contaminants on sediments may redistribute to the water column. Resuspension of sediments may also occur. Volatilization of organic contaminants may occur from soil and water.

The extent to which the contaminants of potential concern for the Hi-Mill site migrate and partition among these media is determined by their physical/chemical properties and the properties of the media. For example, inorganics may partition between soil and water to varying degrees, depending on the solubility of the contaminant, the other ions present, the pH, oxidation-reduction conditions and temperature of the water and the tendency of the contaminant to form complexes with organic or inorganic ligands.

The organic contaminants of concern are mainly volatiles, which are likely to partition from soil to water and to the atmosphere. These contaminants are also likely to migrate in the groundwater, rather than adsorbing to soil, based on adsorption coefficients (K_{OC}) ranging from about 20 to 2,000 (Ney 1990).

3.3.2 Exposure to Contaminants in Soil

All humans ingest small amounts of soil each day. This is believed to be mainly through hand-to-mouth activity, so small children generally ingest more soil than older children or adults. Exposure probably occurs both indoors (from intake of house dust) and outdoors (while playing, gardening, doing yard work, etc.). This pathway is often an important source of exposure.

Hypothetical future on-site residents are likely to come into contact with on-site soils during the activities described above. It is assumed that the asphalt pavement covering the parking lots is removed during residential construction and that contact with all on-site soil is possible. Therefore, this pathway has been selected for quantification.

Current workers at the Hi-Mill plant can be exposed to on-site soil while eating or engaging in recreational activities in the area behind the Hi-Mill building during the lunch period. Picnic tables present in this area are evidence that this type of activity occurs. Workers at the plant work mainly indoors, with the exception of loading and unloading, which occurs on a paved area. The dust in the plant is more likely to be soil from the adjacent highway and the paved parking lot, rather than from the mainly vegetated area behind the building. Therefore, soil ingestion by workers, based on outdoor activities during the lunch period, represents the greatest exposure and was selected for quantification.

Although dermal exposure to soil undoubtedly occurs, this pathway was not selected for quantitative evaluation because appropriate values for some parameters required to quantify dermal exposures to most chemicals are not available at this time (USEPA 1992b). Most of the chemicals of potential

concern at this site are metals and volatile organics. For metals, the dermal absorption from soil is estimated to be very low, but dermal absorption of volatile organics could be more significant. Nevertheless, reliable values for absorption factors for these chemicals are not currently available. The uncertainty associated with not quantifying this pathway is addressed in Section 6.1.

Exposure to soil is usually restricted to surface soil (0 to 1 foot). However, subsurface soil may be brought to the surface during the construction of building foundations, installation of utility lines, etc. Therefore, it is assumed that current workers are exposed only to surface soils in exposed (unpaved) areas, but hypothetical future residents are assumed to be exposed to subsurface soils (1.5 to 12 feet deep).

3.3.3 Exposure to Contaminants in Groundwater

Contaminants in soil can be transported downward to groundwater by infiltration of rain or snowmelt, and contaminated soil can serve as a continuing source of groundwater contamination. Contamination of the shallow aquifer is expected to be of greatest concern. This is supported by monitoring data which indicate contamination is higher in the shallow aquifer than in the intermediate aquifer (Techna Corporation 1990; Geraghty and Miller 1992a).

Under current conditions there are no known populations that use the shallow groundwater near the site either for drinking or any other uses (Techna Corporation 1990). According to information provided by Hi-Mill, the well currently used for drinking and process water at the site is screened at about 100 feet and has been in use for about one and one-half years. This well has been sampled by the MDPH and has not been found to be contaminated[(a)]. Thus, it is unlikely that current workers are exposed to contaminated groundwater on the site. Therefore, this exposure pathway is not complete and was not quantified.

However, in the future, it is unlikely, but possible, that hypothetical on-site residents might install shallow wells for drinking water and/or other indoor uses (toilets, bathing, laundry, etc.). Although an MDPH regulation prohibits screening a drinking water well less than 25 feet below ground level without written permission from a Health Officer (MDPH 1979), it is not unreasonable to assume that such groundwater use might occur if the regulation were changed or ignored.

Pathways of exposure to contaminants in groundwater used for household purposes include not only ingestion, but also dermal contact (while showering or bathing) and inhalation of volatile chemicals released from water into indoor air. All three pathways were selected for quantification for the future on-site residential scenario.

3.3.4 Exposure to Contaminants in Surface Water and Sediments

Contaminants in site soil could lead to contamination of surface water and sediments in nearby surface water bodies (Target Pond and Waterbury Lake) by the transport mechanisms described previously. Monitoring data indicates that

(a) Personal communication with Lois Graham, MDPH, 07/06/92.

some inorganic contaminants (chromium, copper) were detected in Target Pond sediments above background values (Geraghty and Miller 1992b). Current human exposures to these media are expected to be brief and sporadic. It is unlikely that current workers on the site would be exposed to these areas. Current off-site residents or visitors might come to Target Pond occasionally, but it seems unlikely, since the Pond is surrounded by high cattails, making direct exposure difficult. Therefore, current human exposure to surface water and sediments was not quantified.

Future residents, particularly youngsters, are more likely to participate in recreational activities in and around the Pond, thereby being exposed to the surface water and sediments. If it is assumed that the area surrounding Target Pond is cleared during residential development of the site, youngsters could then swim and play in the water during the summer months. Therefore, incidental ingestion of surface water and sediments and dermal exposure to surface water were selected for quantification for future residential youngsters. Dermal exposure to sediments was not quantified, for the same reason detailed in Section 3.3.2

It is possible that humans could be exposed to contaminants in surface water by ingesting fish caught in Target Pond. However, no fish currently inhabit the Pond (Geraghty and Miller 1992b). Although the Pond might be stocked in the future, there is not likely to be any significant exposure to humans by this route, since the chemicals detected in surface water do not tend to bioconcentrate in fish. Bioconcentration factors (BCFs) range from 16 for chromium to 150 for silver (USEPA 1987).

3.3.5 Exposure to Contaminants in Air

On-site contaminants in soil can be released to air either in particulate or gaseous form. Inorganic contaminants of potential concern tend to remain bound to soil particles, and wind or mechanical erosion of soil surfaces could release particles into the air resulting in possible inhalation exposures. However, under current conditions, the site is either paved or almost completely vegetated. Should the property be developed for residential use, it is assumed that following construction of a home, the area would also be either paved or mostly vegetated. Therefore, particulate emissions to air are considered sufficiently minor that this pathway was not quantitatively evaluated.

Volatile emissions to air are inhibited by paving, but not by vegetation. The areas of maximum detected soil contamination are currently paved and workers are exposed outdoors for relatively brief periods. Therefore, inhalation exposures to current workers were not quantified. However, should the paving be removed during future residential development, emissions of VOCs could be increased. It is possible that volatile contaminants might then be released to air in sufficient quantity to cause concern. Therefore, this pathway was quantified for the hypothetical future residential scenario.

Inhalation exposures to contaminants in indoor air from groundwater are addressed in section 3.3.3

3.3.6 Exposure to Contaminants in Homegrown Vegetables

Humans can be indirectly exposed to soil contamination via ingestion of garden vegetables grown in contaminated soil. Since future residential use of the site is reasonable, this pathway could be a source of exposure for a hypothetical future resident who plants a vegetable garden. Although no plant material was analyzed for chemicals of potential concern, chemical-specific uptake of contaminants into vegetables can be estimated, and this pathway was quantified for hypothetical future residents.

3.3.7 Summary of Pathways Selected for Quantification

Table 3-1 summarizes the human exposure pathways at this site that were evaluated quantitatively.

3.4 Quantification of Exposure

The quantification of the magnitude, duration and frequency of the selected exposure scenarios allows the calculation of an average daily intake of the chemicals of potential concern. The intake is an approximation of exposure expressed in terms of the contaminant mass at the body exchange boundary per unit body weight per day (mg/kg-day). To calculate intakes, the following general equation is used:

$$DI = C \cdot HIF \qquad (1)$$

where:

DI = Average daily intake of the chemical (mg/kg-day).
C = Average concentration of the chemical at the exposure point (e.g., mg chemical/unit environmental medium).
HIF = Human Intake Factor (units of environmental medium/kg-day).

Variability among individuals leads to a wide distribution of intake values. The variables in this equation are chosen so that estimates of two points on the distribution are calculated for each pathway: Average (AVG), which is about the 50th percentile, and Reasonable Maximum Exposure (RME) which is about the 95th percentile (USEPA 1989a).

These calculations are accomplished in two steps: (1) the calculation of concentration values (EPCs) and (2) the calculation of HIFs. The calculations for the pathways selected for evaluation at Hi-Mill are described in the following sections.

3.4.1 Calculation of Exposure Point Concentrations

An EPC is the arithmetic mean concentration of a chemical in a medium, averaged over the area over which exposure is expected to occur. Because of the uncertainty associated with estimating the true EPC from a limited number of samples, a degree of conservatism is needed in calculating EPCs (USEPA 1989a). This conservatism is provided by using the upper 95th confidence limit of the arithmetic mean, or the maximum detected value when the number of samples is so small that the upper 95th confidence limit exceeds the maximum detected value. Since it is not known whether the monitoring data are

TABLE 3-1 EXPOSURE PATHWAYS QUANTIFIED FOR THE HI-MILL SITE

Population	Exposure Point	Exposure Medium	Exposure Route
Current			
Worker	Hi-Mill Site (behind building)	Soil	Ingestion
Future			
On-Site Resident Adult/Child	Home	Groundwater	Ingestion Dermal
		Indoor Air	Inhalation
	Backyard	Soil	Ingestion
		Ambient Air	Inhalation
		Vegetables	Ingestion
On-Site Resident Youngster	Target Pond	Surface Water	Ingestion Dermal
		Sediment	Ingestion

normally or lognormally distributed, the more conservative approach was adopted, and this calculation assumes that the monitoring data at this site are normally distributed.

Calculation of EPCs involves (1) selecting exposure points and (2) analyzing available sampling data to estimate the mean concentration of each chemical at each exposure point. These two steps are described in the remainder of this section.

Selection of Exposure Points

Exposure points were selected on the basis of areas at which human contact activities would be likely to occur. The samples selected for calculation of each EPC are listed in Table 3-2 and the selections are explained below. The locations of these samples are identified in Figures 2-1 and 2-2. Detailed calculations for all EPCs are presented in Appendix 1.

Groundwater

There is no documented current use of groundwater from the shallow aquifer. All wells currently being used for drinking water, both on-site and off-site, are screened in the intermediate or deep aquifer (Techna 1990; Geraghty and Miller 1992a). The exposure point selected for a hypothetical future residential scenario assumes that a residence may be constructed on the site and a drinking water well which is screened in the shallow aquifer is dug adjacent to the residence. Three monitoring wells located near the center of the contaminant plume on-site which were screened in the shallow aquifer were used to calculate the groundwater EPC, in accordance with USEPA (1991d) guidance.

The USEPA (1989a) recommends using total, rather than dissolved, metal analysis values for calculating EPCs for ingestion of drinking water. Since only one total analysis was available for the shallow wells selected, the EPCs were calculated using the dissolved metal concentrations. The uncertainty introduced by the use of dissolved metal analytical results, rather than total, is addressed in Section 6.3

Indoor Air

Humans may be exposed to volatile chemicals released to indoor air from household water used for showers, sinks, washing machines, toilets, and other household uses. The magnitude of human exposures via the in-house inhalation route is a complex function of showering and bathing habits, water temperature, shower flow rate, whole-house water usage, the size and characteristics of the bathroom, laundry and whole house, time spent in each room and the physical/chemical properties of the contaminants (e.g., Henry's Law constant). Since site-specific data are not available to support a detailed evaluation of inhalation exposure to volatiles, an air/water concentration ratio of 0.5 was used to estimate the EPCs in indoor air, as suggested in USEPA (1991c).

There is no clear cut-off between chemicals that are sufficiently volatile to be evaluated using this approach and those that are not. The USEPA (1991c) suggests that, for screening level purposes, chemicals with a Henry's Law Constant greater than 1E-05 $atm \cdot m^3/mol$ and a molecular weight less than 200

TABLE 3-2 SUMMARY OF SAMPLES USED TO CALCULATE EXPOSURE POINT CONCENTRATIONS

Exposure Point	Medium	Samples Used in EPC Calculation
On-site, Behind Hi-Mill Building	Surface Soil	A1-0, A2-0, A3-0, A4-0, B1-0, B2-0, B3-0, B4-0, B5-0, C1-0, C2-0, C3-0, C4-0, C5-0, D2-0, D3-0, D4-0, D5-0, D6-0, E2-0, E3-0, E4-0, E5-0, E6-0, E7-0, F3-0, F4-0, F5-0, F6-0, F7-0, F8-0, G3-0, G3/H4-0, G4-0, G5-0, G6-0, G7-0, G8-0, H3-0, H3/I3-0, H4-0, H4/I5-0, H5-0, H6-0, H7-0, H8-0, I5-0, I6-0, I8-0, J5-0, J6-0, J7-0, K3-0, K4-0, K5-0, K6-0, L3-0, L4-0, L5-0, M3-0, M4-0
On-site, Building and Parking Lot Area	Subsurface Soil	RS01-2, RS01-3, RS12-3, RS23-1, RS23-3, RS34-2, RS34-3, SB1-7.5, SB2-7.5, SB3-7.5, SB4-7.5, ST01-3, ST12-3, ST23-2, ST23-3, ST34-2, ST34-3, WV01-1, WV01-2, WV01-3, XW01-1, XW01-2, XW01-3, XW12-1, XW12-2, XW12-3, YX01-1, YX01-2, YX01-3, YX12-1, YX12-2, YX12-3, ZY01-1, ZY01-2, ZY01-3, ZY12-1, ZY12-2, ZY12-3
	Groundwater	SW-1, SW-3, SW-5, SW1, SW3, SW5
Target Pond	Surface Water	TP1, TP2, TP4, TP7, TP9, TP10, TP11
	Sediment	TP1-0, TP2-0, TP3-0, TP4, TP4-0, TP4-1, TP5-0, TP6-0, TP6-1, TP7-0, TP7-1, TP8, TP8-0, TP8-1, TP9-0, TP10-0, TP11-0, TP11-1, TP12-0, TP13, TP14

should be included. All the VOCs detected in groundwater at Hi-Mill (Table 2-3) meet these criteria and inhalation exposure to these chemicals was evaluated for future residents as described above.

Soil

The available data indicate that concentrations of the organic contaminants of potential concern in soil are not uniform across the site, either horizontally or vertically. The soil samples collected from beneath the paved parking lots were analyzed for VOCs, and trichloroethene (TCE) was detected at approximately the same frequency in surface and subsurface soils, but the average concentration was higher in subsurface soil. 1,2-Dichloroethene (1,2-DCE), a degradation product of TCE, was detected only in subsurface soils. During the Phase II sampling, no surface soil samples were collected. TCE was detected in seven subsurface samples analyzed for VOCs.

For the current worker the EPCs were calculated based on exposure to all surface soil in the area behind the Hi-Mill building. The hypothetical future resident is assumed to be exposed to subsurface soil in the area under the current parking lots which was brought to the surface during construction activities. Those EPCs were calculated using all subsurface soil samples in that area to a depth of about 12 feet.

Garden Vegetables

The concentration of contaminants in garden vegetables grown in contaminated soil can be calculated from the concentration in soil as follows:

$$C_V = C_S \cdot BCF_V \qquad (2)$$

where:

C_V = Concentration of contaminant in vegetables (mg/kg)
C_S = Concentration of contaminant in soil (mg/kg)
BCF_V = Bioconcentration factor for vegetables (unitless)

The value of BCF is a chemical-specific and plant-specific term. For the purposes of this assessment, plants were divided into three categories: (1) leafy vegetables (lettuce, cabbage, etc.); (2) root vegetables (carrots, radishes, potatoes, etc.); and (3) garden fruits (tomatoes, corn, etc.).

For inorganic ions, BCF values for leafy vegetables and for root vegetables/garden fruits are given in Baes et al. (1984).

For organic chemicals, BCF values for leafy vegetables are calculated from the following equation (Travis and Arms 1988):

$$\log(BCF_{lV}) = 1.588 - 0.578 \cdot \log(K_{OW}) \qquad (3)$$

Thus,

$$BCF_{lv} = 10^{(1.588 - 0.578 \cdot \log K_{ow})} \quad (4)$$

For root vegetables and garden fruits, BCF values are derived as follows:

$$BCF_{rv} = BCF_{gf} = \frac{RCF}{K_{oc} \cdot foc} \quad (5)$$

where:

RCF = Root concentration factor (unitless)
K_{oc} = Organic carbon/water partition coefficient (unitless)
foc = Fraction of soil that is organic carbon (unitless)

The value of RCF is given by Briggs et al. (1982) as:

$$\log(RCF-0.82) = 0.77 \cdot \log(K_{ow}) - 1.52 \quad (6)$$

Values of K_{oc} are available in the literature for some chemicals. In the absence of data, the value of K_{oc} can be estimated from the value of K_{ow}, as follows (Lyman et al. 1982):

$$\log(K_{oc}) = 0.544 \cdot \log(K_{ow}) + 1.377 \quad (7)$$

Combining these equations yields:

$$BCF_{rv} = BCF_{gf} = \frac{10^{(0.77 \log K_{ow} - 1.52)} + 0.82}{foc \cdot 10^{(0.544 \cdot \log K_{ow} + 1.377)}} \quad (8)$$

The value of foc is site-specific. A value of 0.02 (2%) was assumed to be representative for soils within the area of concern at Hi-Mill (USEPA 1991c).

Adjustment for Wet Weight

The BCF values above are expressed in terms of the dry weight of the vegetable, while human intake is usually described in terms of wet weight. Therefore, each BCF term was corrected by multiplying by the dry weight/wet weight ratio for each vegetable type. Based on data from Baes et al. (1984), these ratios are as follows:

Vegetable Type	Dry Wt./Wet Wt.
Leafy vegetables	0.05
Garden fruits	0.06
Root vegetables	0.12

In order to simplify the overall process of calculating exposure via garden vegetables, the total intake from all three types of vegetable can be calculated as follows:

$$DI_v = DI_{lv} + DI_{rv} + DI_{gf} \quad (9)$$

$$= C_{lv} \cdot HIF_{lv} + C_{rv} \cdot HIF_{rv} + C_{gf} \cdot HIF_{gf}$$

$$HIF_{lv} = HIF_v \cdot f_{lv}$$

$$HIF_{rv} = HIF_v \cdot f_{rv}$$

$$HIF_{gf} = HIF_v \cdot f_{gf}$$

where:

- HIF_v - Total intake of garden vegetables (kg/kg/day).
- f_{lv} - Fraction of total garden vegetable intake comprised of leafy vegetables (unitless).
- f_{rv} - Fraction of total garden vegetable intake comprised of root vegetables (unitless).
- f_{gf} - Fraction of total garden vegetable intake comprised of garden fruit vegetables (unitless).

Based on data on intake of garden vegetables by category (USEPA 1989c), values of f for each class can be calculated as follows:

	% Total			
Category	Adult	Child	Average	f
Leafy vegetable	21	10	15	0.15
Root vegetable	32	45	39	0.39
Garden fruit	47	45	46	0.46
Total	100	100	100	1.00

Using these values of f and substituting for C_{lv}, C_{rv} and C_{gf} from the equations described previously yields:

$$DI_v = C_s \cdot HIF_v \cdot [(0.15)(BCF_{lv}) + (0.39)(BCF_{rv}) + (0.46)(BCF_{gf})] \qquad (10)$$

The term in brackets can then be evaluated for each chemical of potential concern and used to calculate intakes from the concentration in surface soil (C_s) and the total daily intake of garden vegetables (HIF_v).

Ambient air

Volatile contaminants can be released from soil to ambient air and humans may be exposed to these contaminants by inhalation, both indoors and outdoors. The concentrations of VOCs in ambient air can be estimated by using mathematical models. The model described by Hwang (1986) was selected to estimate emission rates of VOCs from soil and a box model (Hanna et al. 1982) was used to estimate VOC concentrations in ambient air resulting from these emissions. The assumptions of the models and detailed calculations are presented in Appendix 2.

Ambient air concentrations were calculated only for those VOCs detected in soil for which inhalation RfDs or slope factors are available. Since the Hwang model assumes an unlimited reservoir of contaminant volatilizing upward through the soil, samples at all soil depths from the area beneath the parking lots were used to calculate the VOC concentrations in soil for input to the model.

Surface Water

Concentrations of contaminants of potential concern are relatively uniform at the sampling locations in the surface water of Target Pond, and there do not appear to be any "hot spots," or apparent gradients of contaminant concentrations. There are no special areas where swimming or playing is most likely to occur, and it is assumed that these activities might occur anywhere in the Pond. Therefore, all surface water samples were averaged to calculate the EPCs for surface water exposure at the Pond.

Sediments

Direct exposure to sediments could occur at any location in Target Pond, since the maximum depth of the Pond is about 4 feet (Geraghty and Miller 1992a). Since the maximum concentrations of contaminants are not all in the same sampling location and there is no apparent gradient of contaminant concentrations, all sediment samples were averaged to calculate the EPCs for exposure to sediments while swimming or playing in the Pond.

Calculation of Concentration Values

Exposure can be evaluated over three time periods: subchronic (2 weeks to 7 years), chronic (between 7 years and a lifetime) and lifetime (the average exposure over a 70-year life span (USEPA 1989a). Each of these time periods has a unique EPC associated with it (C_S, C_C, C_L). These concentrations represent the upper-bound 95th confidence limit of the arithmetic average of the concentrations of contaminants contacted over the time period involved

(USEPA 1989a). In many cases, the concentrations of chemicals in environmental media are not constant, but decrease over time due to evaporation, degradation or other fate and transport processes. Since detailed quantitative data are not available on fate and transport processes at this site, it has been conservatively assumed that the concentrations of chemicals of concern in soil and water remain approximately constant for the next 30 years. This is a reasonable assumption for most of the inorganic chemicals, but may result in an overestimation of exposure for the volatile organic compounds. The uncertainty associated with this assumption is addressed in Section 6.3.

Combining Duplicates

Field duplicate samples were collected according to the procedures reported in the RI (Geraghty and Miller 1992a), with one duplicate collected for approximately every ten samples. These sample pairs represent field duplicates at the same sample location, so it is inappropriate to consider each as an independent measurement of a location. Therefore, one value for each pair was calculated by averaging the reported concentrations, using one-half the reported "U"-qualified value for nondetects. Several samples were reanalyzed for unspecified reasons. These reanalyses were not used in the risk assessment because the data packages were incomplete (detection limits were not provided).

Split samples were collected by EPA for several locations during the Phase II sampling. These samples were considered as field duplicates and the concentration values calculated as described above.

Adjustment for Nondetects

As shown in Table 2-3, concentration values were below the detection limits for a number of chemicals of potential concern in a number of samples. For chemicals that were detected at least once in a particular medium, all nondetects ("U"-qualified values) of that chemical in that medium were evaluated at an assumed concentration of one-half the reported detection limit (CRQL or CRDL). For chemicals never detected in a particular medium, the concentration values were assumed to be zero in that medium. The detailed calculations of the EPCs are presented in Appendix 1. The uncertainties in the risk assessment resulting from these decisions are discussed in Section 6.3.

3.4.2 Calculation of Human Intake Factors

The general equation for the HIF term is:

$$HIF = \frac{CR}{BW} \cdot \frac{(EF)(ED)}{AT} \qquad (11)$$

where:

CR = Contact Rate. This is the average amount of contaminated medium contacted per unit time or event.
BW = Body Weight. This is the average body weight (kg) over the exposure period.

EF = Exposure Frequency. This describes how often exposure occurs per unit time (hr/day, days/yr, etc.)
ED = Exposure Duration. This is the total length of time that exposure occurs within the time period of concern (the averaging time). The product of EF and ED gives the total number of days or events that exposure occurred.
AT = Averaging Time. This is the time period over which the average dose is calculated (days).

In general, the value of HIF is dependent upon the age of the exposed population and the duration of exposure. Thus, it is necessary to distinguish between subchronic, chronic and lifetime average HIF values, designated HIF_s, HIF_c and HIF_l, respectively. Also, each input parameter may assume a range of values because of normal variation in physiological variables and activity patterns among individuals. To help account for this variability and to provide information on the range of exposures which might be expected to occur in a population, two types of HIF terms were calculated: (1) the best estimate value, derived using average (AVG) physiological parameters and activity patterns, and (2) the reasonable maximum value (RME) derived using a combination of average and upper-bound input terms, such that the final estimate of exposure is approximately equal to the 95th percentile of the population distribution of doses. The purpose of the RME is to obtain a conservative estimate of exposure (i.e., well above the average, but not worst case) that is still within the range of possible exposures. The equations and specific values used to derive AVG and RME HIF values for the exposure scenarios assumed at this site are detailed in Appendix 3. The key assumptions are summarized in Table 3-3, and the resulting HIF values are shown in Table 3-4.

3.4.3 Calculation of Average Daily Intakes

Average daily intake values for humans exposed at this site were calculated using the EPCs calculated as described in Section 3.4.1 (Table 3-2 and Appendix 1), and the HIF values summarized in Section 3.4.2 (Table 3-4 and Appendix 3). The appropriate EPC was multiplied by the HIF for each pathway for each population evaluated. The detailed calculations are presented in Appendix 5.

TABLE 3-3 SUMMARY OF HUMAN EXPOSURE ASSUMPTIONS AT HI-MILL

Exposure Pathway	Parameter	Resident Child (Age 1 to 6)		Resident Youngster (Age 7-16)		Resident Adult		Worker	
		AVG	RME	AVG	RME	AVG	RME	AVG	RME
General	Body weight, kg	15[a]	15[a]	43[d]	43[d]	70[a]	70[a]	70[a]	70[a]
	Exposure frequency, days/yr	350[b]	350[b]	13[e]	39[e]	350[b]	350[b]	125[e]	125[e]
	Exposure duration, yr	6[a]	6[a]	10[e]	10[e]	9[a]	30[b]	9[e]	25[b]
	Averaging time (noncancer), yr	6[c]	6[c]	10[c]	10[c]	9[c]	30[c]	9[c]	25[c]
	Averaging time (cancer), yr	70[c]	70[c]	70[c]	70[c]	70[c]	70[c]	70[c]	70[c]
Soil Ingestion	Daily intake, mg/day	100[f]	200[b]	--	--	50[e]	100[b,g]	25[e]	50[e]
Sediment Ingestion	Intake, mg/event	--[h]	--	50[e]	100[e]	--	--	--	--
Vegetable Ingestion	Homegrown intake, g/day	25[e]	40[e]	--	--	50[d]	80[b]	--	--
Inhalation of VOCs, Indoors	Breathing rate, m^3/day	16[d]	18[d]	--	--	13[d]	15[b]	--	--
Inhalation of VOCs, Ambient Air	Breathing rate, m^3/day	20[e]	24[e]	--	--	18[d]	20[b]	--	--
Water Ingestion, Drinking Water	Daily Intake, L/day	0.6[a]	1[a]	--	--	1.4[a]	2[a]	--	--
Dermal Exposure, Groundwater	Skin surface area exposed, cm^2/event	7,200[d]	7,200[d]	--	--	20,000[d]	20,000[d]	--	--
Dermal Exposure, Surface Water	Skin surface area exposed, cm^2/event	--	--	13,000[d]	13,000[d]	--	--	--	--
Water Ingestion, Surface Water	Intake, L/hour	--	--	0.05[a]	0.05[a]	--	--	--	--

(a) Default value recommended by USEPA (1989a).
(b) Default value recommended by USEPA (1991a).
(c) The averaging time for subchronic and chronic exposures (used to evaluate noncancer health effects) is equal to the exposure duration. The averaging time for lifetime exposures (used to evaluate cancer effects) is 70 years.
(d) Estimated according to USEPA guidance (1992b or 1989b).
(e) Assumed value, based on professional judgment. See Appendix 3 for discussion.
(f) USEPA guidance (1991g).
(g) Soil intake by the resident adult is calculated as a time-weighted average, assuming 200 mg/day for six years while a child (body weight = 15 kg) and 100 mg/day for 24 years while an adult (body weight = 70 kg).
(h) -- = not evaluated.

TABLE 3-4 SUMMARY OF HIF CALCULATIONS

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	HIF_S AVG	HIF_S RME	HIF_C AVG	HIF_C RME	HIF_L AVG	HIF_L RME
Future Resident Adult	On-site	Groundwater	Oral	--	--	1.9E-02	2.7E-02	2.5E-03	1.2E-02
			Dermal	--	--	4.6E-02[a]	5.5E-02[a]	5.9E-03[a]	2.3E-02[a]
		Indoor Air	Inhalation	--	--	1.9E-01	2.1E-01	2.5E-02	8.8E-02
		Soil	Oral	--	--	6.8E-07	3.7E-06	8.8E-08	1.6E-06
		Ambient Air	Inhalation	--	--	2.5E-01	2.7E-01	3.2E-02	1.2E-01
		Garden Vegetables	Oral	--	--	6.8E-04	1.1E-03	8.8E-05	4.7E-04
Future Resident Child	On-site	Groundwater	Oral	3.8E-02	6.4E-02	--	--	3.3E-03	5.5E-03
			Dermal	7.7E-02[a]	9.2E-02[a]	--	--	6.6E-03[a]	7.9E-03[a]
		Indoor Air	Inhalation	1.0E+00	1.2E+00	--	--	8.8E-02	9.9E-02
		Soil	Oral	6.4E-06	1.3E-05	--	--	5.5E-07	1.1E-06
		Ambient Air	Inhalation	1.3E+00	1.5E+00	--	--	1.1E-01	1.3E-01
		Garden Vegetables	Oral	1.6E-03	2.6E-03	--	--	1.4E-04	2.2E-04
Future Resident, Youngster	Target Pond	Surface Water	Oral	--	--	2.1E-05	1.2E-04	3.0E-06	1.8E-05
			Dermal	--	--	5.4E-03[a]	3.2E-02[a]	7.7E-04[a]	4.6E-03[a]
		Sediment	Oral	--	--	4.1E-08	2.5E-07	5.9E-09	3.5E-08
Current Worker	On-site	Soil	Oral	--	--	1.2E-07	2.4E-07	1.6E-08	8.7E-08

(a) Dermal HIFs are multiplied by chemical-specific PC values. See Appendix 3, Section 6.3.

4.0 TOXICITY ASSESSMENT

The toxic effects of a chemical generally depend on the level of exposure (dose), the route of exposure (oral, inhalation, dermal) and the duration of exposure (subchronic, chronic or lifetime). Thus, a full description of the toxic effects of a chemical includes a listing of what adverse health effects the chemical can cause (both cancer and noncancer), and how the occurrence of these effects depends upon dose, route and duration of exposure.

4.1 Noncarcinogenic Effects

When data permit, the USEPA derives numeric values that are useful in quantifying the toxicity and carcinogenicity of a compound. For noncancer health effects, the values are termed References Doses (RfDs). These are route- and duration-specific estimates of the average daily intake (mg chemical/kg-day) that may occur without appreciable risk of any adverse effect. Because the quality and quantity of toxicologic data available to support derivation of RfD values varies among chemicals, USEPA also provides an indication of the overall confidence associated with each RfD value. In general, the lower the confidence, the more conservative USEPA is in deriving the RfD. Table 4-1 provides a summary of the characteristic noncancer effects and lists available RfD values and confidence categories for all verified RfDs for all of the chemicals of potential concern at this site.

4.2 Carcinogenic Effects

For cancer, the numeric descriptors of carcinogenic potency are termed Slope Factors (SFs). These are route-specific estimates of the slope of the cancer dose-response curve at low doses. (It is assumed the curve is linear in this region and passes through the origin). The units of the SFs are $(mg/kg\text{-}day)^{-1}$. In addition, USEPA assigns a cancer weight-of-evidence category to each chemical in order to reflect the overall confidence that chemical is likely to cause cancer in humans. These categories and their meanings are summarized below.

Category	Meaning	Basis
A	Known human carcinogen	Sufficient evidence of increased cancer incidence in exposed humans.
B1	Probable human carcinogen	Sufficient evidence of increased cancer incidence in animals, with suggestive evidence from studies of exposed humans.
B2	Probable human carcinogen	Sufficient evidence of increased cancer incidence in animals, but lack of data or insufficient data from humans.
C	Possible human carcinogen	Suggestive evidence of carcinogenicity in animals.
D	Cannot be evaluated	No evidence or inadequate evidence of cancer in animals or humans.

TABLE 4-1 SUMMARY OF NONCARCINOGENIC EFFECTS AND TOXICITY VALUES FOR CHEMICALS OF POTENTIAL CONCERN AT HI-MILL[a]

Chemical	Effect/Route	Oral			Inhalation		
		RfD_S[b]	RfD_C[b]	Confidence Level	RfD_S[b]	RfD_C[b]	Confidence Level
Acetone	Increased liver and kidney weights, nephrotoxicity/oral	1.0E+00	1.0E-01	Low	--	--	--
Aluminum	Asthma, pulmonary fibrosis/inhalation; neurological disorders/oral and kidney dialysis (ATSDR 1990a)	--	--	--	--	--	--
Ammonia	Respiratory lesions, decreased pulmonary function/inhalation	9.7E-01	9.7E-01	--	2.9E-02	2.9E-02	Medium
Antimony	Decreased longevity, changes in blood glucose, cholesterol/oral	4.0E-04	4.0E-04	Low	--	--	--
Arsenic	Mucous membrane irritation/inhalation; liver and kidney effects/oral; keratosis, hyperpigmentation, neurological disorders/both routes (ATSDR 1991a)	3.0E-04	3.0E-04	Medium	--	--	--
Barium	Hypertension-oral	7.0E-02	7.0E-02	Medium	1.4E-03	1.4E-04	--
Beryllium	No adverse effects noted in study which formed the basis of the RfD	5.0E-03	5.0E-03	Low	--	--	--
Bromodichloromethane	Kidney, liver and thyroid gland toxicity/ oral	2.0E-02	2.0E-02	Medium	--	--	--
Bis(2-ethylhexyl)phthalate	Liver toxicity, reproductive and developmental effects/oral (ATSDR 1991b)	2.0E-02	2.0E-02	Medium	--	--	--
2-Butanone	Central nervous system effects, fetotoxicity/inhalation	5.0E-01	5.0E-02[c]	Medium[c]	9.0E-01	2.9E-01	--
Cadmium (food)	Renal damage/both routes; impaired respiratory function/inhalation; possible immune alterations-oral (ATSDR 1991c)	--	1.0E-03	High	--	--	--
(water)		--	5.0E-04	High	--	--	--
Chlorobenzene	Liver damage/oral	2.0E-01	2.0E-02	Medium	5.0E-02	5.0E-03	--

continued-

(a) All information from either IRIS Database (USEPA 1992a) or HEAST Summary Tables (USEPA 1991e) unless otherwise noted.
(b) Units of the RfD are mg/kg-day.
(c) Withdrawn from IRIS.

Table 4-1 - continued

Chemical	Effect/Route	Oral			Inhalation		
		RfD_S	RfD_C	Confidence Level	RfD_S	RfD_C	Confidence Level
Chloroform	Liver and kidney toxicity/inhalation and oral; central nervous system depression/inhalation (ATSDR 1991d)	1.0E-02	1.0E-02	Medium	--	--	--
Chromium (VI)	Atrophy of nasal mucosa/inhalation; no effects defined after oral exposure	2.0E-02	5.0E-03	Low	--	--	--
Chromium (III)	Reduced liver and spleen weights/oral	1E+00	1E+00	Low	--	--	--
Cobalt	Asthma, fibrosis/inhalation. Cardiomyopathy/oral (ATSDR 1990b)	--	--	--	--	--	--
Copper	Gastrointestinal irritation/oral	3.7E-02[a]	3.7E-02[a]	--	--	--	--
Cyanide (free)	Weight loss, thyroid effects, myelin degeneration/oral	2.0E-02	2.0E-02	Medium	--	--	--
Di-n-butylphthalate	Increased mortality/oral	1.0E+00	1.0E-01	Low	--	--	--
1,1-Dichloroethane	Renal damage/inhalation; no effect/oral	1.0E+00	1.0E-01	--	1.4E+00	1.4E-01	--
1,2-Dichloroethene (total)[b]	Hematologic changes/oral	9.0E-03	9.0E-03	--	--	--	--
Ethylbenzene	Liver and kidney effects/oral; developmental toxicity/inhalation	1.0E+00	1.0E-01	Low	2.9E-01	2.9E-01	Low
Lead	Neurological deficiencies, hypertension, inhibition heme synthesis, reproductive effects/both routes (ATSDR 1991e)	--[c]	--[c]	--	--	--	--
Mercury	Neurotoxicity/inhalation; kidney effects/oral	3.0E-04	3.0E-04	--	--	--	--
Methylene chloride	Liver toxicity/oral	6.0E-02	6.0E-02	Medium	8.6E-01	8.6E-01	--
4-Methyl-2-pentanone	Liver and kidney effects/oral and inhalation	5.0E-01	5.0E-02	--	2.3E-01	2.3E-02	--

continued

(a) Value calculated from the current drinking water standard; toxicity data considered inadequate for RfD calculation (USEPA 1992a).
(b) Based on values for cis-1,2-dichloroethene.
(c) Lead will be evaluated based on acceptable blood lead levels using the UBK model.

Table 4-1 - continued

Chemical	Effect/Route	Oral			Inhalation		
		RfD_S	RfD_C	Confidence Level	RfD_S	RfD_C	Confidence Level
Nickel (soluble salts)	Hematological, developmental effects/oral; respiratory, immune and reproductive effects/inhalation (ATSDR 1991f)	2.0E-02	2.0E-02	Medium	--	--	--
Nitrate	Methemoglobinemia/oral	1.6E+00[a]	1.6E+00	High	--	--	--
Nitrite	Methemoglobinemia/oral	1.0E-01	1.0E-01	High	--	--	--
Silver	Argyria/oral	5.0E-03	5.0E-03	Low	--	--	--
1,1,2,2-Tetrachloroethane	--	--	--	--	--	--	--
Tetrachloroethene	Liver and kidney effects/both routes central nervous system depression/ inhalation (ATSDR 1991g)	1.0E-01	1.0E-02	Medium	--	--	--
Toluene	Changes in liver and kidney weights/oral; central nervous system effects-inhalation	2.0E+00	2.0E-01	Medium	5.7E-01	1.1E-01	--
1,1,1-Trichloroethane	Growth retardation, liver changes/ inhalation	9.0E-01	9.0E-02[b]	Medium[b]	2.9E+00	2.9E-01	
1,1,2-Trichloroethane	Liver effects/oral	4.0E-2	4.0E-3	Medium	--	--	--
Trichloroethene	Liver, kidney effects/both routes; central nervous system depression/ inhalation (ATSDR 1991h)	--	6.0E-03[c]	--	--	--	--
Vanadium	Renal and gastrointestinal effects/oral; respiratory irritation/inhalation	7.0E-03	7.0E-03	--	--	-	--
Vinyl acetate	No effect on body and kidney weight/oral	1.0E+00	2.0E-01	--	5.7E-02	5.7E-02	--
Vinyl chloride	--	--	--	--	--	--	--
Xylenes (total)	Central nervous system toxicity/oral and inhalation; developmental effects/oral	4.0E+00	2.0E+00	Medium	--	--	--

(a) The subchronic RFD is assumed to be equivalent to the chronic RFD.
(b) Removed from IRIS; under review.
(c) Provisional value.

Table 4-2 provides a brief summary of the characteristic cancer effects of chemicals of potential concern at this site and lists available oral and inhalation SFs and cancer weight-of-evidence categories.

More detailed reviews of the toxicity of those chemicals found to contribute to risk levels that approach or exceed a level of concern (i.e., antimony, arsenic, 1,2-dichloroethene, nitrate + nitrite, trichloroethene and vinyl chloride) are presented in Appendix 4.

4.3 Dermal Toxicity Values

Since dermal exposure to surface water and groundwater are also of concern at the site, dermal toxicity values are also required. It is important to note that dermal toxicity values must be based on the absorbed dose (rather than the exposed or administered dose), since dermal intakes are calculated as absorbed doses. Since the USEPA has not yet established any dermal toxicity values, approximate values were derived by extrapolation from oral toxicity values. This was done by multiplying the oral subchronic or chronic RfD values by the oral absorption fraction (AF_o), and dividing the oral slope factor by the oral absorption fraction. Absorption fractions are chemical-specific values obtained from the toxicological studies including, if available, the studies used in determining toxicity values. This approach is based on the assumption that equal absorbed doses are equitoxic. For most organic chemicals of potential concern at Hi-Mill, the AF_o was assumed to be 1.0 (i.e., 100% oral absorption), since most organic compounds are fairly well absorbed from the gastrointestinal tract. This is, however, not the most conservative approach since a lower AF_o would result in a lower RfD or higher slope factor. Risk may, therefore, be underestimated. Oral absorption of metals is quite variable, with values ranging from 0.5% to 50%, while absorption of arsenic is estimated to be 100% (Owen 1990; Lagerkvist et al. 1986, USEPA 1991e). Therefore, individual AF_o values for inorganic chemicals of potential concern have been used to calculate dermal toxicity values. The AF_o values used for each chemical and the resulting dermal toxicity values are presented on page A5-2 in Appendix 5.

TABLE 4-2 SUMMARY OF CARCINOGENIC EFFECTS AND SLOPE FACTORS FOR CHEMICALS OF POTENTIAL CONCERN AT HI-MILL[a]

Chemical	Cancer Type/Route	Weight of Evidence	Slope Factor, (mg/kg-day)$^{-1}$ Oral	Inhalation
Arsenic	Lung/inhalation; skin cancer/oral; limited evidence of other internal cancers/both routes	A	1.8E+00	1.5E+01
Beryllium	Lung cancer/inhalation. Osteosarcomas/injection (intravenous or intramedullary)	B2	4.3E+00	8.4E+00
Bis(2-ethylhexyl)phthalate	Liver/oral	B2	1.4E-02	--
Bromodichloromethane	Kidney, large intestine and liver/oral	B2	1.3E-01	--
Cadmium	Lung, prostate/inhalation; insufficient evidence of carcinogenicity/oral	B1 (inhalation)	--	6.3E+00
Chloroform	Kidney and liver/inhalation and oral	B2	6.1E-03	8.1E-02
Chromium (VI)	Lung/inhalation	A (inhalation)	--	4.2E+01
Lead	Renal tumors/oral (ATSDR 1991e)	B2	--	--
Methylene chloride	Liver/oral and inhalation	B2	7.5E-03	1.6E-03
Nickel	Lung and nasal cancer/inhalation of nickel refinery dust; Insufficient evidence of carcinogenicity/oral	A (inhalation)	--	8.4E-01[b]
1,1,2,2-Tetrachloroethane	Liver tumors/oral	C	2.0E-01	2.0E-01

continued

(a) Information from IRIS Database (USEPA 1992a) or HEAST Annual-1991 (USEPA 1991e) unless otherwise noted. Only chemicals with slope factors calculated by USEPA are included here.
(b) Inhalation slope factor for nickel refinery dust.

Table 4-2 - continued

Chemical	Cancer Type/Route	Weight of Evidence	Slope Factor, $(mg/kg\text{-}day)^{-1}$ Oral	Inhalation
Tetrachloroethene[a]	Liver/inhalation and oral; leukemia/ inhalation	B2	5.2E-02	2.0E-03
1,1,2-Trichloroethane	Liver/oral	C	5.7E-02	5.7E-02
Trichloroethene[a]	Liver/oral; lung/inhalation	B2	1.1E-02	6.0E-03
Vinyl chloride	Lung/oral; liver/inhalation	A	1.9E+00	3.0E-01

(a) The carcinogenicity assessment has been withdrawn by USEPA and is under review. However, the USEPA recommends using these values for risk assessment for the present (personal communication with Erin Moran, USEPA Region V, 07/06/92).

5.0 RISK CHARACTERIZATION

Risk characterization integrates the results of the exposure and toxicity assessments into a quantitative description of cancer and noncancer risks. The method for risk characterization utilized in this baseline risk assessment is consistent with guidance provided in USEPA (1989a).

5.1 Evaluation of Carcinogenic Risks

The risk of cancer from exposure to a chemical is described in terms of the probability that an individual exposed for his or her entire lifetime will develop cancer by age 70. For each chemical of concern, this value is calculated from the daily intake of the chemical from the site, averaged over a lifetime (DI_L) and the SF for the chemical, as follows:

$$Cancer\ Risk = 1 - \exp(-DI_L \cdot SF) \quad (12)$$

In most cases (except when the product of $DI_L \cdot SF$ is larger than about 0.01), excess cancer risk may be estimated more simply as:

$$Cancer\ Risk = DI_L \cdot SF \quad (13)$$

Excess cancer risks are summed across all chemicals of potential concern and all exposure pathways that contribute to exposure of an individual in a given population. Typically, the USEPA requires remedial action at a site when total excess cancer risk levels to any current or future population exceed 1E-04 (USEPA 1991c).

Using the average lifetime daily intake values calculated as described in Section 3.4 and the slope factors described in Section 4.2 (see Table 4-2), cancer risks were calculated for populations who may be chronically exposed at the Hi-Mill Site. The detailed calculations are presented in Appendix 5, and the results are summarized in Table 5-1. Due to the inherent uncertainty in cancer risk calculations, all cancer risk values are reported to only one significant figure.

Cancer Risk by Population

Table 5-1 lists estimated excess cancer risks by medium for each population exposed at each location at the Hi-Mill site. The media and chemicals contributing to these risks are discussed below.

Current Workers

Total excess cancer risk for current workers ranges from 5E-07 (AVG) to 2E-06 (RME) and is based almost entirely on ingestion of arsenic from soil in the area behind the current Hi-Mill facility. Section 5.3 discusses how much of the arsenic may be naturally occurring and how much may be from other sources.

TABLE 5-1 SUMMARY OF EXCESS CANCER RISKS FOR POPULATIONS AT HI-MILL

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	Cancer Risk AVG	Cancer Risk RME
Current Worker	On-Site	Soil	Oral	5E-07	2E-06
Future Resident, Adult	On-Site	Groundwater	Oral	4E-04	2E-03
			Dermal	6E-05	2E-04
		Indoor Air	Inhalation	5E-04	2E-03
		Soil	Oral	7E-07	1E-05
		Ambient Air	Inhalation	3E-09	1E-08
		Garden Vegetables	Oral	4E-07	2E-06
			Total:	1E-03	4E-03
Future Resident, Child	On-Site	Groundwater	Oral	5E-04	9E-04
			Dermal	7E-05	8E-05
		Indoor Air	Inhalation	2E-03	2E-03
		Soil	Oral	4E-06	8E-06
		Ambient Air	Inhalation	1E-08	1E-08
		Garden Vegetables	Oral	6E-07	1E-06
			Total:	3E-03	3E-03
Future Resident, Youngster	Target Pond	Surface Water	Oral	--(a)	--
			Dermal	--	--
		Sediment	Oral	9E-08	5E-07
			Total:	9E-08	5E-07

(a) No carcinogenic chemicals detected in surface water.

Future On-Site Residents

For future residents, the excess cancer risk is dominated by exposure to TCE and vinyl chloride in groundwater. The total excess cancer risk ranges from 1E-03 (AVG) to 4E-03 (RME) for adults and is 3E-03 (AVG and RME) for children. For adults, RME oral exposure to groundwater and inhalation exposure to VOCs in groundwater volatilized into indoor air each contribute a risk of 2E-03. RME exposure to vinyl chloride contributes a risk of 1E-03 by the oral route and 8E-04 by inhalation and RME exposure to TCE contributes a risk of 5E-04 by the oral route, 9E-04 by inhalation and 2E-04 by the dermal route. The distribution of risk is similar for AVG exposures and for children (AVG and RME). Arsenic in groundwater also contributes to the estimated excess cancer risk.

The estimated excess cancer risk for future residential populations from each of the other pathways quantified, including oral exposure to soil and garden vegetables, inhalation of ambient air and exposures while swimming at Target Pond, is less than 1E-04.

5.2 Evaluation of Noncancer Effects

The potential for noncancer effects from exposure to a chemical is evaluated by comparing the estimated intake of the chemical over a specific time period with the RfD for that chemical derived for a similar exposure period. This comparison results in a noncancer hazard quotient, as follows:

$$HQ = DI/RfD \qquad (14)$$

where:

HQ = Hazard Quotient for subchronic (HQ_S) or chronic (HQ_C) exposure
DI = Daily Intake (mg/kg-day), either from subchronic (DI_S) or chronic (DI_C) exposure
RfD = Reference Dose (mg/kg-day), either for subchronic (RfD_S) or chronic (RfD_C) exposure

Since exposure occurs simultaneously to more than one chemical, HQ values are summed as follows:

$$HI = HQ_1 + HQ_2 + HQ_3 \ldots . HQ_i \qquad (15)$$

where:

HI = Hazard Index for either subchronic or chronic exposure
HQ_1 = Hazard Quotient for the first chemical
HQ_i = Hazard Quotient for the i^{th} chemical

Since some individuals are exposed by more than one pathway, Hazard Index (HI) values are summed for each pathway that contributes to the exposure of an individual in a given population. If the total HI is equal to or less than one (1E+00), it is believed that there is no appreciable risk that noncancer health effects will occur. If an HI exceeds 1E+00, there is some possibility

TABLE 5-2 SUMMARY OF HAZARD INDICES FOR FOR POPULATIONS AT HI-MILL

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	Hazard Index[a] AVG	Hazard Index[a] RME
Current Worker	On-Site	Soil	Oral	2E-02	4E-02
Future Resident, Adult	On-Site	Groundwater	Oral	2E+01	3E+01
			Dermal	6E+00	7E+00
		Indoor Air	Inhalation	2E-01	3E-01
		Soil	Oral	2E-02	2E-01
		Ambient Air	Inhalation	8E-06	8E-06
		Garden Vegetables	Oral	8E-02	1E-01
			Total:	3E+01	4E+01
Future Resident, Child	On-Site	Groundwater	Oral	1E+01	2E+01
			Dermal	2E-01	2E-01
		Indoor Air	Inhalation	4E-01	5E-01
		Soil	Oral	2E-01	4E-01
		Ambient Air	Inhalation	1E-05	1E-05
		Garden Vegetables	Oral	2E-01	3E-01
			Total:	1E+01	2E+01
Future Resident, Youngster	Target Pond	Surface Water	Oral	4E-04	2E-03
			Dermal	1E-03	1E-02
		Sediment	Oral	1E-02	6E-02
			Total:	1E-02	7E-02

(a) Hazard Index is subchronic for child resident and chronic for all other populations.

that noncancer effects may occur, although an HI above 1E+00 does not indicate an effect will definitely occur. In particular, summing HQ values across all chemicals and HI values across all pathways assumes that all noncancer effects are additive.

Since this is not always true, when a population total HI exceeds 1E+00, it is appropriate to re-examine the noncancer effects for that individual and segregate them by effect (USEPA 1989a).

The methods for calculation of average daily intakes were summarized in Section 3.3, and chemical specific RfD values were summarized in Section 4.1 (see Table 4-1). Based on these, HQ and HI values for subchronic (HI_S) and chronic (HI_C) exposures were calculated for each exposure scenario evaluated at this site. The detailed calculations are presented in Appendix 5 and the results are summarized below. Because of the uncertainty inherent in calculation of HQ values, all HQ and HI values are reported to only one significant figure.

Noncancer Risks by Population

Table 5-2 shows the total HI values by medium for populations exposed at this site. The HI values for the future resident adult and child populations range from 2E+01 (AVG) to 3E+01 (RME) and 1E+01 (AVG) to 2E+01 (RME), respectively, from ingestion of groundwater. The calculated HIs for dermal exposure of adults to groundwater ranged from 6E+00 (AVG) to 7E+00 (RME). The chemicals contributing substantially to these HI values are antimony, nitrate+nitrite, 1,2-dichloroethene and trichloroethene in groundwater. Each of these chemicals has an HQ value greater than 1E+00. Therefore, there is no need to segregate by target tissue. On this basis, it is possible that future residents at this site could be at risk from the noncarcinogenic effects of these chemicals.

For all other populations and pathways, the HI values are less than 1E+00, so noncarcinogenic effects due to these exposures do not appear to be of concern.

Noncancer Risks from Exposure to Lead

Since there are no EPA-approved RfD values for lead, it is not possible to evaluate the noncancer risks of lead by calculation of an HQ. An alternative approach is to estimate the likely effect of lead exposure on the concentration of lead in the blood (PbB). Several mathematical models have been developed for calculating the value of PbB as a function of environmental concentrations of lead (USEPA 1989a). Of these, the Uptake/Biokinetic (UBK) model has the greatest flexibility and has been most thoroughly validated, so it is selected for use here. The basic equation for calculating PbB with UBK model is:

$$PbB = (\Sigma\, C_i \cdot I_i \cdot ABS_i) \cdot BKSF \qquad (16)$$

where:

C_i = Concentration of lead in medium i (μg/unit medium)
I_i = Human intake of medium i (units medium/day)
ABS_i = Absorption fraction of lead from medium i (unitless)

BKSF = Biokinetic slope factor relating blood lead to absorbed dose. The units of BKSF are µg/dL per µg/day.

In general, the values of I, ABS and BKSF are all age dependent, and the value of PbB at any given age is a complex function of both current and past lead exposure levels. It is commonly agreed that young children are more susceptible to the effects of lead than older children or adults, since (1) young children tend to have higher exposure levels (especially to soil), (2) young children have higher lead absorption rates, and (3) the nervous system of infants and young children is more sensitive to the neurological effects of lead. The USEPA has developed a computer program ("LEAD5") for calculating lead exposures and the resulting PbB values in children age 0-6. This program was used to evaluate the effects of lead in environmental media on children at this site. It should be noted that these calculations include lead exposure from all sources (including food and area-wide emissions to air), and not just those specifically derived from the site (soil and water). Most input parameters (e.g., body weight, water intake, soil intake, breathing rate, concentration of lead in air, and lead intake from the diet) were taken to be the national average values suggested as defaults by the USEPA. The concentrations of lead in soil and water were the site-specific values calculated as described in Section 3.4.1.

Although there is no universally agreed upon value of PbB that may be identified as "safe" for the effects of lead on children, the U.S. Department of Health and Human Services has concluded that some adverse health effects have been observed at a level of 10 µg/dL, and identified as a goal the reduction of children's blood lead levels to below 10 µg/dL (CDC 1991). The USEPA also considers values above 10 µg/dL to be of concern, and has recommended that, for an exposed population of children, no more than 5% of the population exceed this value (USEPA 1991f). The geometric mean PbB value for future residential children at Hi-Mill is predicted to be 1.51 µg/dL with virtually all children (ages 0 to 6 years) having PbB values below 10 µg/dL. Based upon this, it appears that lead exposure from soil and water to hypothetical future residents is not a cause for concern.

5.3 Sources of Chemicals Contributing Significant Risk

As discussed in Section 2.3, chemicals of potential concern were selected without regard to the most likely source of contamination. Thus, some chemicals of potential concern could come from off-site sources and some could be partly or entirely natural in origin. The likely sources of those chemicals of potential concern which were found to be contributing risk levels of potential concern are discussed below.

Vinyl chloride, TCE and 1,2-DCE are widely distributed in shallow groundwater at the Hi-Mill site, as shown by the CLP data used in this risk assessment and by the field GC data collected by Geraghty and Miller (1992a). TCE is associated with site activities and 1,2-DCE and vinyl chloride are degradation products of TCE, so the presence of these chemicals is apparently site-related.

Arsenic is a naturally-occurring element present in both soil and groundwater on-site. Arsenic was also detected in background soils, at about half the average concentration detected on-site (see Appendix 6). Therefore, it is likely that the arsenic is, at least in part, from natural sources. Antimony

and nitrate+nitrite are also naturally-occurring substances, but antimony was not detected in background soil and no background groundwater samples were identified. There is no information relating these chemicals directly to site activities. Thus, the probable sources of these chemicals cannot be specified.

6.0 ASSESSMENT OF UNCERTAINTIES

There are a number of factors which contribute uncertainty to the estimates of exposure and risk presented in this report. The most important of these are discussed below.

6.1 Nonquantification of Some Exposure Pathways

The total risk to a human from contaminants at a site is the sum of the risks of all complete exposure pathways that exist. At this site, some complete pathways (e.g., dermal exposure to soils and sediments) have not been quantified because of lack of data or because it is believed that these are small sources of exposure compared to those that have been quantified. Nevertheless, this is a source of uncertainty and could lead to an underestimate of exposure and risk.

6.2 Uncertainties from Chemicals Excluded

As discussed in Section 2.2, a number of chemicals were not included because they were never detected in any on-site samples. Excluding these chemicals introduces uncertainty because of the possibility that some of the chemicals may actually have been present, but at levels below detection limits. It is important to stress that there is no reason to believe that these chemicals are actually present on site, at least at levels approaching detection limits, but this is nevertheless a source of uncertainty that could result in an underestimate of exposure and risk.

As discussed in Section 2.3.3, several TICs were detected in samples from Hi-Mill media. Most TICs were reported as unknowns or as a member of a class of compounds (i.e., alkane). Risks from TICs were not evaluated because their identities were not considered sufficiently established. Since these types of compounds are not known to be carcinogenic or highly toxic, exclusion of these TICs from the risk assessment is not likely to lead to a significant underestimate of risk.

6.3 Uncertainties in Exposure Point Concentrations

As discussed in Section 3.3.1, there is often considerable uncertainty inherent in calculating EPCs, especially if the available data have a high frequency of nondetects, or if there are only a few data points at a given exposure point. At this site it was assumed that chemicals detected in a given medium but never detected at an exposure point within that medium are actually present, and all nondetects were evaluated at one-half the reported detection limit. Since most of the excess carcinogenic risk at this site is attributable to chemicals that were frequently detected, it is not believed that this approach has led to a significant overestimate of the total risk at the site. However, the risk of noncarcinogenic effects occurring due to antimony may be overestimated.

Also, as discussed earlier, it has been conservatively assumed that all EPCs will remain constant over time, at least for the next 30 years. While values for most contaminants are not expected to decrease dramatically, it is nevertheless true that fate and transport processes will probably tend to decrease levels of volatile organic contaminants over time. Thus, this approach could lead to an overestimate of exposure and risk.

For metals in drinking water, dissolved metal analytical results were used to calculate the EPCs. Since these values are often lower than the total metal analytical values, this is likely to underestimate risk from these chemicals. In order to quantify the magnitude of the underestimate, the total metal analysis values for one groundwater sample were compared with the dissolved metal values for the same sample. Chromium, copper and nickel were not detected in the dissolved analysis, but were detected in the total analysis at levels about 75 to 150 times greater than the dissolved analysis reported detection limits. While it is inappropriate to base conclusions on results from a single sample, it appears that oral exposure to metals in groundwater could be considerably underestimated.

Additional uncertainty is introduced by the possible presence of "hot spots" (small areas of high concentration) in soil and also possibly in the groundwater. Whether or not such hot spots are detected is a function of the size of the hot spot and the pattern used to select sampling locations. If the sampling plan leads to a disproportionate number of samples from hot spots, then the resulting estimate of average concentration is likely to be too high. Conversely, if hot spots are missed, then the estimated average concentration may be too low. There are areas of soil where high levels of copper or chromium were detected. If future residents were to get all their exposure at one of these locations, the risk of noncarcinogenic effects from these chemicals might approach a level of concern.

6.4 Uncertainties in Modeling Approaches

Whenever monitoring data are lacking and models are used to calculate EPCs, uncertainty is generated as a result of limitations in the models themselves and because of uncertainty in the input parameters employed. In the case of inhalation exposure to volatiles released to indoor air from household water usage, it is probable that the simplified approach to evaluating this pathway (assuming the indoor air concentration is 0.5 times the concentration in water) is more likely to lead to an overestimate than an underestimate of risk by this pathway. The risks from this pathway are sufficiently large that uncertainties in the approach used to estimate exposure could significantly influence risk conclusions.

Inhalation exposure to volatiles released from source-area soils into air was also modeled (Appendix 2). The estimated air concentrations and resulting risks are so small that any uncertainties in the models are unlikely to alter the conclusion that exposure via this pathway is of no practical concern.

Mathematical models were also used to estimate the concentrations of contaminants in garden vegetables. The models employed are basically empirical in nature (i.e., they extrapolate from available data using best-fit equations), so predicted values could be wrong if individual chemicals do not fit the empirical equations well. This is especially true for chemicals which may undergo metabolism and/or storage in the plant tissues. Thus, there is a high degree of uncertainty in the predicted contaminant levels in food, but it is not known if the predicted values tend to overestimate or underestimate exposure.

6.5 Uncertainties in Human Intake Factors

Even if the average concentration of a chemical in a medium were known precisely, there is still considerable uncertainty in dose estimates because of uncertainty in the terms used to estimate human contact with the medium. For example, the amount of soil ingested each day by children and adults is likely to be highly variable, and only limited data are available to estimate average intake levels for different age groups. The intake of homegrown vegetables is also highly uncertain. In keeping with USEPA guidance (USEPA 1989a), the terms used to estimate RME human exposure levels have been selected in a way so that dose estimates are at the upper end of the expected dose distribution, while average doses are intended to estimate the typical case. However, neither the AVG nor the RME dose estimates are precisely known and should be viewed as approximations of the central tendency and high end of the dose distribution curve.

6.6 Uncertainties in Critical Toxicity Values

The accuracy of human health risk predictions for any specific estimated dose level depends upon the accuracy of the RfD or SF for the chemical. In many cases, these values are derived from a limited data base, and this can result in substantial uncertainty, both quantitatively and qualitatively. In order to account for these uncertainties and others associated with the evaluation of toxicity data, both RfDs and SFs are derived in a way that is intentionally conservative; that is, risk estimates based on these RfDs and SFs are more likely to be high than low.

Since there is no information on the fraction of total chromium that is Cr^{+6} at Hi-Mill, a conservative approach was taken and the oral RfDs for Cr^{+6} were used to calculate risk from exposure to total chromium in all Hi-Mill media. Since Cr^{+6} was analyzed for and not detected in surface water and sediments, the use of the Cr^{+6} RfDs may overestimate risk from these media. However, chromium is not contributing significantly to noncarcinogenic risk by any pathway at any exposure point evaluated. Thus, it is apparent that even if all the chromium were present as Cr^{+6}, the presence of this chemical at the site would not be of concern to human health at the exposure points evaluated.

Dermal toxicity values are calculated by extrapolation from oral RfDs and SFs (see Section 4.3). These extrapolated values are highly uncertain due to the uncertainty associated with the oral absorption fractions. It is not known whether these extrapolations lead to an underestimate or overestimate of risk from dermal exposure.

6.7 Lack of Toxicity Values

In cases where RfD or SF values have not been derived for a chemical (see Tables 4-1 and 4-2), it is not possible to derive quantitative estimates of risk. Chemicals for which there are no critical toxicity values (CTVs) include aluminum, cobalt and lead. Additionally, RfD values are particularly sparse for inhalation exposure to volatiles. These data gaps lead to an underestimation of risk which could be substantial, but the true magnitude of the error is unknown.

6.8 Summary

Table 6-1 summarizes the primary sources of uncertainty in this risk assessment.

TABLE 6-1 SUMMARY OF PRIMARY SOURCES OF UNCERTAINTY IN THIS RISK ASSESSMENT

Factors Likely to Underestimate Exposure or Risk

- Lack of RfDs or SFs for all chemicals and all routes
- Nonquantification of some exposure pathways
- Exclusion from consideration of some chemicals possibly present but never detected
- Assumption that chemicals never detected in a medium are absent from that medium

Factors Likely to Overestimate Exposure or Risk

- Use of conservative HIF terms
- Use of conservative RfDs or SFs
- Use of concentration values that are constant over time
- Use of simple rule to predict air exposures to VOCs from water
- Assumption that chemicals detected in a medium are present in all samples of that medium

Factors That Might Underestimate or Overestimate Exposure or Risk

- Use of 1/2 the detection limit to evaluate nondetects
- Possible occurrence of "hot spots"
- Use of models to predict concentration of contaminants in garden vegetables and ambient air

7.0 SUMMARY

This baseline risk assessment is an analysis of the potential adverse health effects (both current and future) resulting from exposures to hazardous substances in soil, groundwater, surface water and sediments at Hi-Mill. By definition, a baseline risk assessment is limited to conditions under the no-action alternative (that is, in the absence of any remedial actions to control or mitigate releases).

The methods used in this RA were developed by the USEPA specifically for evaluations of risk at hazardous waste sites (USEPA 1989a). Major steps in the risk assessment are summarized in the following sections.

7.1 Chemicals of Potential Concern

Analytical data from soil, groundwater, surface water and sediments were evaluated to identify chemicals of potential concern at this site. Any chemical detected in any sample was considered to be a possible chemical of concern. Chemicals were eliminated from consideration only if they are essential nutrients and are nontoxic at the levels encountered on site. The 38 chemicals selected as contaminants of potential concern are listed in Table 7-1.

7.2 Exposure Scenarios Evaluated

Based on a review of site conditions including land use, contamination patterns and human activity patterns, the populations most likely to be exposed are:

- Current on-site workers
- Future on-site residents (adults and children)

The most important exposure pathways are judged to be:

- Ingestion of contaminated groundwater, soil, surface water and sediments.
- Ingestion of homegrown vegetables.
- Dermal exposure to surface water and groundwater.
- Inhalation exposure to VOCs released from groundwater to indoor air and from soil to ambient air.

The exposure scenarios quantified in this risk assessment are summarized in Table 7-2.

7.3 Estimated Human Health Risks

The risk of cancer from exposure to a chemical is described in terms of the probability that an individual exposed for his or her lifetime will develop cancer. Typically, cancer risks of 1.0E-06 (one in a million) or lower are considered to be so small that they are of no practical concern. Higher cancer risk levels may be cause for concern, and the USEPA typically requires

TABLE 7-1 CHEMICALS OF POTENTIAL CONCERN AT HI-MILL

Volatiles	Semivolatiles
Acetone	Bis(2-ethylhexyl)phthalate
Bromodichloromethane	Di-n-butylphthalate
Butanone, 2-	
Chlorobenzene	Inorganics
Chloroform	
Dichloroethane, 1,1-	Aluminum
Dichloroethene, 1,2-	Ammonia-N
Ethylbenzene	Antimony
Methyl-2-pentonone, 4-	Arsenic
Methylene chloride	Barium
Tetrachloroethane,	Beryllium
1,1,2,2-	Cadmium
Tetrachloroethene	Chromium
Toluene	Cobalt
Trichloroethane, 1,1,1-	Copper
Trichloroethane, 1,1,2-	Cyanide
Trichloroethene	Lead
Vinyl acetate	Mercury
Vinyl chloride	Nickel
Xylene (total)	Nitrate+Nitrite
	Silver
	Vanadium

TABLE 7-2 EXPOSURE PATHWAYS QUANTIFIED FOR THE HI-MILL SITE

Population	Exposure Point	Exposure Medium	Exposure Route
Current			
Worker	Hi-Mill Site (behind building)	Soil	Ingestion
Future			
On-Site Resident Adult/Child	Home	Groundwater	Ingestion Dermal
		Indoor Air	Inhalation
	Backyard	Soil	Ingestion
		Ambient Air	Inhalation
		Vegetables	Ingestion
On-Site Resident Youngster	Target Pond	Surface Water	Ingestion Dermal
		Sediment	Ingestion

the remediation if risks exceed 1E-04. Estimated cancer risks from exposures to the chemicals of potential concern at Hi-Mill are summarized in Table 7-3.

The carcinogenic risk for hypothetical future populations is dominated by the exposure to chemicals in groundwater, by both the oral and inhalation routes. Estimated cancer risks range from 3E-03 (AVG and RME) for children to 1E-03 (AVG) to 4E-03 (RME) for adults. Chemicals contributing to these risks are mainly TCE and vinyl chloride. Arsenic is the primary contributor to risks from soil. For current workers, the estimated cancer risk ranges from 5E-07 (AVG) to 2E-06 (RME).

Evaluation of noncarcinogenic risk is accomplished by comparing a calculated intake with an acceptable intake for each chemical and for each pathway that contributes to a population's exposure. The ratio of the calculated intake versus the acceptable intake is termed the HI. Hazard Indices calculated for all the exposure scenarios quantified at Hi-Mill are summarized in Table 7-4.

For noncarcinogenic risks, ingestion of groundwater by hypothetical future residents also dominates the risk assessment. The HIs, both subchronic and chronic (AVG and RME), are greater than 1E+00 for future residential oral groundwater exposures. Chemicals contributing to these HIs include antimony, nitrate + nitrite, 1,2-DCE and TCE. The individual HQs for these chemicals all are 2E+00 or greater for one or more future resident drinking water exposures. These values indicate that hypothetical future residents using groundwater for drinking water may have some risk of the effects associated with exposure to these chemicals.

The likely effect of exposures to lead from site contamination in blood lead levels in young children were estimated using the UBK. Geometric mean blood lead levels are predicted to be 1.51 µg/dL for the residential population evaluated. It therefore appears that lead is not a source of concern at this site.

7.4 Uncertainties

There are a number of stages in the risk assessment process where precise evaluations are not possible. These include uncertainties regarding the true concentrations of chemicals in environmental media, the amount of contaminants taken in by humans, and the likely consequences of the resulting exposure.

While some of these limitations lead to an underestimate of risk (e.g., lack of appropriate toxicity data, inability to quantify some exposure pathways), most assumptions and professional judgments made are more likely to overestimate than underestimate risk. Consequently, the risks derived for this site should be considered approximate and are more likely to be high than low.

TABLE 7-3 SUMMARY OF EXCESS CANCER RISKS FOR POPULATIONS AT HI-MILL

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	Cancer Risk AVG	Cancer Risk RME
Current Worker	On-Site	Soil	Oral	5E-07	2E-06
Future Resident, Adult	On-Site	Groundwater	Oral	4E-04	2E-03
			Dermal	6E-05	2E-04
		Indoor Air	Inhalation	5E-04	2E-03
		Soil	Oral	7E-07	1E-05
		Ambient Air	Inhalation	3E-09	1E-08
		Garden Vegetables	Oral	4E-07	2E-06
			Total:	1E-03	4E-03
Future Resident, Child	On-Site	Groundwater	Oral	5E-04	9E-04
			Dermal	7E-05	8E-05
		Indoor Air	Inhalation	2E-03	2E-03
		Soil	Oral	4E-06	8E-06
		Ambient Air	Inhalation	1E-08	1E-08
		Garden Vegetables	Oral	6E-07	1E-06
			Total:	3E-03	3E-03
Future Resident, Youngster	Target Pond	Surface Water	Oral	--(a)	--
			Dermal	--	--
		Sediment	Oral	9E-08	5E-07
			Total:	9E-08	5E-07

(a) No carcinogenic chemicals detected in surface water.

TABLE 7-4 SUMMARY OF HAZARD INDICES FOR FOR POPULATIONS AT HI-MILL

Exposed Population	Exposure Point	Exposure Medium	Exposure Route	Hazard Index[a] AVG	Hazard Index[a] RME
Current Worker	On-Site	Soil	Oral	2E-02	4E-02
Future Resident, Adult	On-Site	Groundwater	Oral	2E+01	3E+01
			Dermal	6E+00	7E+00
		Indoor Air	Inhalation	2E-01	3E-01
		Soil	Oral	2E-02	2E-01
		Ambient Air	Inhalation	8E-06	8E-06
		Garden Vegetables	Oral	8E-02	1E-01
			Total:	3E+01	4E+01
Future Resident, Child	On-Site	Groundwater	Oral	1E+01	2E+01
			Dermal	2E-01	2E-01
		Indoor Air	Inhalation	4E-01	5E-01
		Soil	Oral	2E-01	4E-01
		Ambient Air	Inhalation	1E-05	1E-05
		Garden Vegetables	Oral	2E-01	3E-01
			Total:	1E+01	2E+01
Future Resident, Youngster	Target Pond	Surface Water	Oral	4E-04	2E-03
			Dermal	1E-03	1E-02
		Sediment	Oral	1E-02	6E-02
			Total:	1E-02	7E-02

(a) Hazard Index is subchronic for child resident and chronic for all other populations.

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APPENDIX 1

EXPOSURE POINT CONCENTRATIONS CALCULATIONS

The following worksheets provide detail on the calculations of exposure point concentrations. Each worksheet consists of chemical sample concentrations and a summary of statistics (i.e., arithmetic mean, standard deviation) for that exposure point.

The following provides a page reference to each.

DATA STATISTICS

DATE: 06/30/92
FILENAME S-1_STAT

EXPOSURE POINT: ON-SITE
MEDIUM: SOIL-1
UNITS: MG/KG
U MULTIPLIER: 0.5

	CHEMICAL	HITS	TOTAL	MAX	MIN	AM	STDS	AM95	EPC
1	Aluminum	38	38	1.8E+04	2.8E+03	1.1E+04	4.0E+03	1.2E+04	1.2E+04
2	Antimony	0	1	6.6E+00	6.6E+00	6.6E+00	0.0E+00	0.0E+00	6.6E+00
3	Arsenic	1	1	2.3E+00	2.3E+00	2.3E+00	0.0E+00	0.0E+00	2.3E+00
4	Barium	1	1	1.4E+02	1.4E+02	1.4E+02	0.0E+00	0.0E+00	1.4E+02
5	Beryllium	1	1	8.6E-01	8.6E-01	8.6E-01	0.0E+00	0.0E+00	8.6E-01
6	Cadmium	1	1	1.3E+00	1.3E+00	1.3E+00	0.0E+00	0.0E+00	1.3E+00
7	Chromium	38	38	4.2E+01	4.6E+00	1.9E+01	8.5E+00	2.2E+01	2.2E+01
8	Cobalt	1	1	8.6E+00	8.6E+00	8.6E+00	0.0E+00	0.0E+00	8.6E+00
9	Copper	33	38	1.6E+02	1.1E+00	2.5E+01	4.0E+01	3.6E+01	3.6E+01
10	Lead	1	1	1.4E+01	1.4E+01	1.4E+01	0.0E+00	0.0E+00	1.4E+01
11	Mercury	0	1	6.5E-02	6.5E-02	6.5E-02	0.0E+00	0.0E+00	6.5E-02
12	Nickel	38	38	3.1E+01	8.4E+00	2.0E+01	7.1E+00	2.2E+01	2.2E+01
13	Silver	0	38	1.2E+00	4.7E-01	1.0E+00	1.9E-01	1.1E+00	1.1E+00
14	Vanadium	1	1	3.6E+01	3.6E+01	3.6E+01	0.0E+00	0.0E+00	3.6E+01
15	Cyanide	0	1	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
16	Ammonia-N	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
17	Nitrate + Nitrite	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
18	Acetone	1	38	7.5E-02	5.5E-03	1.8E-02	1.9E-02	2.3E-02	1.4E-02
19	Bromodichloromethane	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
20	Butanone, 2-	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
21	Chlorobenzene	3	38	1.6E-02	2.5E-03	3.9E-03	3.3E-03	4.8E-03	4.8E-03
22	Chloroform	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
23	Dichloroethane, 1,1-	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
24	Dichloroethene, 1,2- (total)	12	38	1.3E-01	2.0E-03	1.4E-02	2.9E-02	2.2E-02	2.2E-02
	Ethylbenzene	2	38	1.6E-02	2.0E-03	3.6E-03	2.8E-03	4.4E-03	2.5E-03
	Methyl-2-pentanone, 4-	1	38	3.1E-02	5.0E-03	7.2E-03	5.6E-03	8.8E-03	5.0E-03
27	Methylene chloride	0	38	2.3E-02	3.0E-03	5.2E-03	4.5E-03	6.4E-03	6.4E-03
28	Tetrachloroethane, 1,1,2,2-	1	38	1.6E-02	2.8E-03	3.7E-03	2.8E-03	4.4E-03	2.8E-03
29	Tetrachloroethene	2	38	2.3E-01	3.0E-03	1.1E-02	3.8E-02	2.1E-02	2.1E-02
30	Toluene	5	38	3.7E-02	3.0E-03	5.2E-03	6.1E-03	6.9E-03	6.9E-03
31	Trichloroethane, 1,1,1-	4	38	1.6E-02	1.0E-03	3.8E-03	3.1E-03	4.6E-03	4.6E-03
32	Trichloroethane, 1,1,2-	1	38	1.6E-02	2.8E-03	3.7E-03	2.8E-03	4.4E-03	2.8E-03
33	Trichloroethene	24	38	6.1E+00	1.0E-03	2.4E-01	1.0E+00	5.2E-01	5.2E-01
34	Vinyl acetate	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
35	Vinyl chloride	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
36	Xylenes (total)	3	38	1.6E-02	2.0E-03	3.6E-03	2.9E-03	4.4E-03	2.0E-03
37	Bis(2-ethylhexyl)phthalate	1	1	2.1E-01	2.1E-01	2.1E-01	0.0E+00	0.0E+00	2.1E-01
38	Di-n-butylphthalate	0	1	2.2E-01	2.2E-01	2.2E-01	0.0E+00	0.0E+00	2.2E-01

DATA STATISTICS

DATE: 07/01/92
FILENAME GW_STAT

EXPOSURE POINT: ON-SITE
MEDIUM: GROUNDWATER
UNITS: MG/L
U MULTIPLIER: 0.5

	CHEMICAL	HITS	TOTAL	MAX	MIN	AM	STDS	AM95	EPC
1	Aluminum	2	6	3.9E-01	2.8E-02	1.0E-01	1.4E-01	2.2E-01	2.2E-01
2	Antimony	0	2	2.6E-02	2.2E-02	2.4E-02	2.5E-03	3.5E-02	2.6E-02
3	Arsenic	1	2	4.2E-03	1.5E-03	2.9E-03	1.9E-03	1.1E-02	4.2E-03
4	Barium	1	2	5.6E-02	2.1E-02	3.9E-02	2.5E-02	1.5E-01	5.6E-02
5	Beryllium	0	2	5.0E-04	5.0E-04	5.0E-04	0.0E+00	5.0E-04	5.0E-04
6	Cadmium	0	2	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
7	Chromium	0	6	1.1E-02	3.0E-03	4.5E-03	3.0E-03	6.9E-03	6.9E-03
8	Cobalt	0	2	7.0E-03	2.0E-03	4.5E-03	3.5E-03	2.0E-02	7.0E-03
9	Copper	0	6	5.5E-03	2.5E-03	4.3E-03	1.2E-03	5.3E-03	5.3E-03
10	Lead	0	2	1.6E-03	1.0E-03	1.3E-03	4.2E-04	3.2E-03	1.6E-03
11	Mercury	1	2	3.6E-04	1.0E-04	2.3E-04	1.8E-04	1.1E-03	3.6E-04
12	Nickel	3	6	1.1E-01	4.5E-03	2.7E-02	4.2E-02	6.2E-02	6.2E-02
13	Silver	0	4	4.5E-03	3.3E-03	4.2E-03	6.3E-04	4.9E-03	4.5E-03
14	Vanadium	0	2	4.0E-03	2.5E-03	3.3E-03	1.1E-03	8.0E-03	4.0E-03
15	Cyanide	1	1	3.7E-02	3.7E-02	3.7E-02	0.0E+00	0.0E+00	3.7E-02
16	Ammonia-N	3	3	1.0E+00	1.5E-01	4.9E-01	4.5E-01	1.2E+00	1.0E+00
17	Nitrate + Nitrite	1	3	1.6E+01	2.5E-02	5.4E+00	9.2E+00	2.1E+01	1.6E+01
18	Acetone	0	5	8.0E-02	5.0E-03	2.6E-02	3.1E-02	5.5E-02	5.5E-02
19	Bromodichloromethane	0	5	2.5E-02	2.5E-03	8.5E-03	9.3E-03	1.7E-02	1.7E-02
20	Butanone, 2-	1	5	4.5E-02	5.0E-03	1.9E-02	1.7E-02	3.5E-02	3.5E-02
21	Chlorobenzene	0	5	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
22	Chloroform	0	5	2.5E-02	2.5E-03	8.5E-03	9.3E-03	1.7E-02	1.7E-02
23	Dichloroethane, 1,1-	0	5	2.5E-02	2.5E-03	8.5E-03	9.3E-03	1.7E-02	1.7E-02
24	Dichloroethene, 1,2- (total)	6	6	1.4E+00	4.5E-03	3.6E-01	5.2E-01	7.9E-01	7.9E-01
	Ethylbenzene	0	5	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
	Methyl-2-pentanone, 4-	0	5	5.0E-02	5.0E-03	1.5E-02	2.0E-02	3.4E-02	3.4E-02
27	Methylene chloride	0	5	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
28	Tetrachloroethane, 1,1,2,2-	0	5	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
29	Tetrachloroethene	0	5	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
30	Toluene	0	5	2.5E-02	2.5E-03	8.5E-03	9.3E-03	1.7E-02	1.7E-02
31	Trichloroethane, 1,1,1-	0	5	2.5E-02	2.5E-03	8.5E-03	9.3E-03	1.7E-02	1.7E-02
32	Trichloroethane, 1,1,2-	0	5	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
33	Trichloroethene	3	6	6.7E+00	2.5E-03	1.3E+00	2.7E+00	3.5E+00	3.5E+00
34	Vinyl acetate	0	5	5.0E-02	5.0E-03	1.5E-02	2.0E-02	3.4E-02	3.4E-02
35	Vinyl chloride	3	5	6.8E-02	3.5E-03	3.3E-02	2.8E-02	6.0E-02	6.0E-02
36	Xylenes (total)	0	5	2.5E-02	2.5E-03	8.5E-03	9.3E-03	1.7E-02	1.7E-02
37	Bis(2-ethylhexyl)phthalate	0	1	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
38	Di-n-butylphthalate	0	1	5.0E-03	5.0E-03	5.0E-03	0.0E+00	0.0E+00	5.0E-03

DATA STATISTICS

DATE: 06/30/92
FILENAME SW_STAT

EXPOSURE POINT: TARGET POND
MEDIUM: SURFACE WATER
UNITS: MG/L
U MULTIPLIER: 0.5

	CHEMICAL	HITS	TOTAL	MAX	MIN	AM	STDS	AM95	EPC
1	Aluminum	1	7	5.4E+00	4.3E-02	8.0E-01	2.0E+00	2.3E+00	2.3E+00
2	Antimony	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3	Arsenic	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
4	Barium	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
5	Beryllium	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
6	Cadmium	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
7	Chromium	2	7	1.4E-02	3.5E-03	6.9E-03	5.0E-03	1.1E-02	1.1E-02
8	Cobalt	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
9	Copper	0	7	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
10	Lead	2	3	4.3E-03	1.0E-03	2.8E-03	1.6E-03	5.6E-03	4.3E-03
11	Mercury	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
12	Nickel	4	7	3.0E-01	5.5E-03	1.4E-01	1.4E-01	2.5E-01	2.5E-01
13	Silver	2	7	1.1E-02	4.5E-03	5.8E-03	2.6E-03	7.7E-03	7.7E-03
14	Vanadium	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
15	Cyanide	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
16	Ammonia-N	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
17	Nitrate + Nitrite	0	1	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
18	Acetone	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
19	Bromodichloromethane	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
20	Butanone, 2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
21	Chlorobenzene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
22	Chloroform	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
23	Dichloroethane, 1,1-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
24	Dichloroethene, 1,2- (total)	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
25	Ethylbenzene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
26	Methyl-2-pentanone, 4-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
27	Methylene chloride	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
28	Tetrachloroethane, 1,1,2,2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
29	Tetrachloroethene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
30	Toluene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
31	Trichloroethane, 1,1,1-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
32	Trichloroethane, 1,1,2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
33	Trichloroethene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
34	Vinyl acetate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
35	Vinyl chloride	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
36	Xylenes (total)	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
37	Bis(2-ethylhexyl)phthalate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
38	Di-n-butylphthalate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

DATA STATISTICS

DATE: 06/30/92
FILENAME SED_STAT

EXPOSURE POINT: TARGET POND
MEDIUM: SEDIMENT
UNITS: MG/KG
U MULTIPLIER: 0.5

	CHEMICAL	HITS	TOTAL	MAX	MIN	AM	STDS	AM95	EPC
1	Aluminum	21	21	3.4E+04	1.2E+04	2.0E+04	6.7E+03	2.2E+04	2.2E+04
2	Antimony	0	7	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
3	Arsenic	7	7	6.7E+00	1.2E+00	4.1E+00	1.8E+00	5.4E+00	5.4E+00
4	Barium	7	7	2.7E+02	1.0E+02	1.8E+02	6.1E+01	2.3E+02	2.3E+02
5	Beryllium	4	7	1.9E+00	3.9E-01	9.2E-01	4.8E-01	1.3E+00	1.3E+00
6	Cadmium	4	7	6.0E+00	1.5E+00	2.9E+00	1.6E+00	4.1E+00	4.1E+00
7	Chromium	21	21	2.4E+03	1.7E+01	3.6E+02	6.4E+02	6.0E+02	6.0E+02
8	Cobalt	6	7	1.2E+01	4.1E+00	7.2E+00	2.4E+00	8.9E+00	8.9E+00
9	Copper	20	21	1.7E+04	1.4E+00	2.0E+03	4.2E+03	3.6E+03	3.6E+03
10	Lead	7	7	1.4E+02	1.1E+01	6.2E+01	5.0E+01	9.8E+01	9.8E+01
11	Mercury	1	7	7.3E-01	5.3E-02	3.1E-01	2.4E-01	4.9E-01	4.9E-01
12	Nickel	21	21	4.2E+01	7.3E+00	2.4E+01	8.1E+00	2.7E+01	2.7E+01
13	Silver	1	21	4.8E+00	1.1E+00	1.8E+00	8.5E-01	2.1E+00	2.1E+00
14	Vanadium	7	7	4.4E+01	2.7E+01	3.6E+01	5.5E+00	4.0E+01	4.0E+01
15	Cyanide	0	3	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
16	Ammonia-N	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
17	Nitrate + Nitrite	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
18	Acetone	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
19	Bromodichloromethane	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
20	Butanone, 2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
21	Chlorobenzene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
22	Chloroform	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
23	Dichloroethane, 1,1-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
24	Dichloroethene, 1,2- (total)	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
25	Ethylbenzene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
5	Methyl-2-pentanone, 4-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
27	Methylene chloride	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
28	Tetrachloroethane, 1,1,2,2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
29	Tetrachloroethene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
30	Toluene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
31	Trichloroethane, 1,1,1-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
32	Trichloroethane, 1,1,2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
33	Trichloroethene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
34	Vinyl acetate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
35	Vinyl chloride	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
36	Xylenes (total)	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
37	Bis(2-ethylhexyl)phthalate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
38	Di-n-butylphthalate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

DATA STATISTICS

DATE: 06/30/92
FILENAME WRK_STAT

EXPOSURE POINT: ON-SITE (WORKER)
MEDIUM: SURFACE SOIL
UNITS: MG/KG
U MULTIPLIER: 0.5

	CHEMICAL	HITS	TOTAL	MAX	MIN	AM	STDS	AM95	EPC
1	Aluminum	61	61	2.7E+04	2.2E+03	1.2E+04	6.5E+03	1.3E+04	1.3E+04
2	Antimony	1	4	6.4E+01	6.5E+00	2.4E+01	2.7E+01	5.6E+01	1.7E+01
3	Arsenic	4	4	1.4E+01	3.3E+00	7.4E+00	4.9E+00	1.3E+01	1.3E+01
4	Barium	3	4	1.3E+02	5.3E+01	7.4E+01	3.8E+01	1.2E+02	1.2E+02
5	Beryllium	3	4	1.3E+00	3.4E-01	8.1E-01	4.8E-01	1.4E+00	1.2E+00
6	Cadmium	4	4	1.1E+01	1.0E+00	3.6E+00	4.7E+00	9.1E+00	9.1E+00
7	Chromium	61	61	4.4E+03	7.4E+00	1.1E+02	5.6E+02	2.3E+02	2.3E+02
8	Cobalt	2	4	1.8E+01	2.3E+00	1.0E+01	7.0E+00	1.9E+01	1.5E+01
9	Copper	52	61	5.0E+03	1.2E+00	3.3E+02	8.5E+02	5.1E+02	5.1E+02
10	Lead	4	4	6.0E+01	1.5E+01	2.9E+01	2.1E+01	5.3E+01	5.3E+01
11	Mercury	0	4	4.3E-01	6.0E-02	1.6E-01	1.8E-01	3.7E-01	3.7E-01
12	Nickel	59	60	5.0E+01	5.0E+00	1.5E+01	8.5E+00	1.7E+01	1.7E+01
13	Silver	0	61	1.1E+01	1.0E+00	1.4E+00	1.3E+00	1.7E+00	1.7E+00
14	Vanadium	3	4	5.2E+01	1.0E+01	2.7E+01	1.8E+01	4.8E+01	4.8E+01
15	Cyanide	0	4	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
16	Ammonia-N	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
17	Nitrate + Nitrite	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
18	Acetone	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
19	Bromodichloromethane	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
20	Butanone, 2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
21	Chlorobenzene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
22	Chloroform	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
23	Dichloroethane, 1,1-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
24	Dichloroethene, 1,2- (total)	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
25	Ethylbenzene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
26	Methyl-2-pentanone, 4-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
27	Methylene chloride	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
28	Tetrachloroethane, 1,1,2,2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
29	Tetrachloroethene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
30	Toluene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
31	Trichloroethane, 1,1,1-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
32	Trichloroethane, 1,1,2-	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
33	Trichloroethene	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
34	Vinyl acetate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
35	Vinyl chloride	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
36	Xylenes (total)	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
37	Bis(2-ethylhexyl)phthalate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
38	Di-n-butylphthalate	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00

SAMPLES USED FOR THESE STATISTICS

HMS-A1-0	HMS-D2-0	HMS-F6-0	HMS-H5-0	HMS-L3-0
HMS-A2-0	HMS-D3-0	HMS-F7-0	HMS-H6-0	HMS-L4-0
HMS-A3-0	HMS-D4-0	HMS-F8-0	HMS-H7-0	HMS-L5-0
HMS-A4-0	HMS-D5-0	HMS-G3-0	HMS-H8-0	HMS-M3-0
HMS-B1-0	HMS-D6-0	HMS-G3/H4-0	HMS-I5-0	HMS-M4-0
HMS-B2-0	HMS-E2-0	HMS-G4-0	HMS-I6-0	
HMS-B3-0	HMS-E3-0	HMS-G5-0	HMS-I8-0	
HMS-B4-0	HMS-E4-0	HMS-G6-0	HMS-J5-0	
HMS-B5-0	HMS-E5-0	HMS-G7-0	HMS-J6-0	
HMS-C1-0	HMS-E6-0	HMS-G8-0	HMS-J7-0	
HMS-C2-0	HMS-E7-0	HMS-H3-0	HMS-K3-0	
HMS-C3-0	HMS-F3-0	HMS-H3/I3-0	HMS-K4-0	
HMS-C4-0	HMS-F4-0	HMS-H4-0	HMS-K5-0	
HMS-C5-0	HMS-F5-0	HMS-H4/I5-0	HMS-K6-0	

DATA STATISTICS

EXPOSURE POINT: ON-SITE
MEDIUM: GARDEN VEGETABLES
UNITS: MG/KG
U MULTIPLIER: 0.5

DATE: 06/30/92
FILENAME: VEG_STAT

	CHEMICAL	HITS	TOTAL	MAX	MIN	AM	STDS	AM95	BCF	CALC EPC	ADJUSTED EPC
1	Aluminum	38	38	1.8E+04	2.8E+03	1.1E+04	4.0E+03	1.2E+04	7.8E-05	1.2E+04	9.1E-01
2	Antimony	0	1	6.6E+00	6.6E+00	6.6E+00	0.0E+00	0.0E+00	3.7E-03	6.6E+00	2.4E-02
3	Arsenic	1	1	2.3E+00	2.3E+00	2.3E+00	0.0E+00	0.0E+00	7.5E-04	2.3E+00	1.7E-03
4	Barium	1	1	1.4E+02	1.4E+02	1.4E+02	0.0E+00	0.0E+00	2.2E-03	1.4E+02	3.2E-01
5	Beryllium	1	1	8.6E-01	8.6E-01	8.6E-01	0.0E+00	0.0E+00	1.9E-04	8.6E-01	1.6E-04
6	Cadmium	1	1	1.3E+00	1.3E+00	1.3E+00	0.0E+00	0.0E+00	1.5E-02	1.3E+00	2.0E-02
7	Chromium	38	38	4.2E+01	4.6E+00	1.9E+01	8.5E+00	2.2E+01	3.9E-04	2.2E+01	8.5E-03
8	Cobalt	1	1	8.6E+00	8.6E+00	8.6E+00	0.0E+00	0.0E+00	6.7E-04	8.6E+00	5.8E-03
9	Copper	33	38	1.6E+02	1.1E+00	2.5E+01	4.0E+01	3.6E+01	2.2E-02	3.6E+01	7.8E-01
10	Lead	1	1	1.4E+01	1.4E+01	1.4E+01	0.0E+00	0.0E+00	1.0E-03	1.4E+01	1.4E-02
11	Mercury	0	1	6.5E-02	6.5E-02	6.5E-02	0.0E+00	0.0E+00	2.2E-02	6.5E-02	1.4E-03
12	Nickel	38	38	3.1E+01	8.4E+00	2.0E+01	7.1E+00	2.2E+01	4.9E-03	2.2E+01	1.1E-01
13	Silver	0	38	1.2E+00	4.7E-01	1.0E+00	1.9E-01	1.1E+00	1.0E-02	1.1E+00	1.1E-02
14	Vanadium	1	1	3.6E+01	3.6E+01	3.6E+01	0.0E+00	0.0E+00	2.6E-04	3.6E+01	9.5E-03
15	Cyanide	0	1	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
16	Ammonia-N	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
17	Nitrate + Nitrite	0	0	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
18	Acetone	1	38	7.5E-02	5.5E-03	1.8E-02	1.9E-02	2.3E-02	5.7E-01	1.4E-02	8.0E-03
19	Bromodichloromethane	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
20	Butanone, 2-	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
21	Chlorobenzene	3	38	1.6E-02	2.5E-03	3.9E-03	3.3E-03	4.8E-03	3.1E-02	4.8E-03	1.5E-04
22	Chloroform	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
23	Dichloroethane, 1,1-	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
24	Dichloroethene, 1,2- (total)	12	38	1.3E-01	2.0E-03	1.4E-02	2.9E-02	2.2E-02	4.9E-02	2.2E-02	1.1E-03
	thylbenzene	2	38	1.6E-02	2.0E-03	3.6E-03	2.8E-03	4.4E-03	3.1E-02	2.5E-03	7.8E-05
	Methyl-2-pentanone, 4-	1	38	3.1E-02	5.0E-03	7.2E-03	5.6E-03	8.8E-03	1.1E-01	5.0E-03	5.5E-04
27	Methylene chloride	0	38	2.3E-02	3.0E-03	5.2E-03	4.5E-03	6.4E-03	1.4E-01	6.4E-03	8.7E-04
28	Tetrachloroethane, 1,1,2,2-	1	38	1.6E-02	2.8E-03	3.7E-03	2.8E-03	4.4E-03	3.5E-02	2.8E-03	9.5E-05
29	Tetrachloroethene	2	38	2.3E-01	3.0E-03	1.1E-02	3.8E-02	2.1E-02	3.3E-02	2.1E-02	6.9E-04
30	Toluene	5	38	3.7E-02	3.0E-03	5.2E-03	6.1E-03	6.9E-03	3.1E-02	6.9E-03	2.2E-04
31	Trichloroethane, 1,1,1-	4	38	1.6E-02	1.0E-03	3.8E-03	3.1E-03	4.6E-03	3.3E-02	4.6E-03	1.6E-04
32	Trichloroethane, 1,1,2-	1	38	1.6E-02	2.8E-03	3.7E-03	2.8E-03	4.4E-03	4.3E-02	2.8E-03	1.2E-04
33	Trichloroethene	24	38	6.1E+00	1.0E-03	2.4E-01	1.0E+00	5.2E-01	3.4E-02	5.2E-01	1.8E-02
34	Vinyl acetate	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
35	Vinyl chloride	0	38	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	NA	0.0E+00	0.0E+00
36	Xylenes (total)	3	38	1.6E-02	2.0E-03	3.6E-03	2.9E-03	4.4E-03	3.1E-02	2.0E-03	6.3E-05
37	Bis(2-ethylhexyl)phthalate	1	1	2.1E-01	2.1E-01	2.1E-01	0.0E+00	0.0E+00	6.8E-02	2.1E-01	1.4E-02
38	Di-n-butylphthalate	0	1	2.2E-01	2.2E-01	2.2E-01	0.0E+00	0.0E+00	4.2E-02	2.2E-01	9.0E-03

DATA STATISTICS

DATE: 07/07/92
FILENAME HNG_SOIL

EXPOSURE POINT: ON-SITE (HWANG INPUT)
MEDIUM: SOIL
UNITS: MG/KG
U MULTIPLIER: 0.5

	CHEMICAL	HITS	TOTAL	MAX	MIN	AM	STDS	AM95	EPC
1	Chlorobenzene	3	56	1.6E-02	2.5E-03	3.6E-03	2.7E-03	4.3E-03	4.3E-03
2	Ethylbenzene	2	56	1.6E-02	2.0E-03	3.4E-03	2.4E-03	4.0E-03	2.5E-03
3	Methyl-2-pentanone, 4-	1	56	3.1E-02	5.0E-03	6.8E-03	4.7E-03	7.9E-03	5.0E-03
4	Methylene chloride	0	56	2.3E-02	3.0E-03	4.9E-03	4.0E-03	5.8E-03	5.8E-03
5	Tetrachloroethane, 1,1,2,2-	1	56	1.6E-02	2.5E-03	3.4E-03	2.3E-03	4.0E-03	2.8E-03
6	Tetrachloroethene	2	56	2.3E-01	2.5E-03	8.2E-03	3.1E-02	1.5E-02	1.5E-02
7	Toluene	8	56	1.4E-01	3.0E-03	7.5E-03	1.9E-02	1.2E-02	1.2E-02
8	Trichloroethane, 1,1,1-	5	56	1.6E-02	1.0E-03	3.5E-03	2.6E-03	4.1E-03	4.1E-03
9	Trichloroethane, 1,1,2-	1	56	1.6E-02	2.5E-03	3.4E-03	2.3E-03	4.0E-03	2.8E-03
10	Trichloroethene	38	56	6.1E+00	1.0E-03	1.7E-01	8.4E-01	3.6E-01	3.6E-01
11	Xylenes (total)	3	56	1.6E-02	2.0E-03	3.4E-03	2.4E-03	3.9E-03	2.0E-03

APPENDIX 2

DETAILED DESCRIPTION OF MODELS USED TO CALCULATE AIR CONCENTRATIONS OF VOCs RELEASED FROM SOIL

1.0 INTRODUCTION

The concentration of volatile organic chemicals (VOCs) in air that result from releases from contaminated soil is a complex function of soil, chemical and meteorological parameters. Estimation of the concentration values is usually approached in two steps: first, the emission rate of each volatile from soil is calculated, and then the resultant concentration in air is calculated. Methods used to achieve these steps are detailed below.

2.0 EMISSION MODEL

Hwang (1986) developed a mathematical model for estimating the average emission rate of a chemical from soil that considers the physical-chemical properties of the chemical (its volatility and its tendency to sorb to soil and dissolve in water) and the characteristics of the soil (the amount of organic matter in the soil and the amount of pore space between soil particles). The model assumes that the concentration of chemical at the surface will tend to decrease over time due to volatilization, so the emission rate also decreases as a function of time.

The basic equation proposed by Hwang (1986) is:

$$Q = C_s \cdot \frac{2 \cdot E \cdot De \cdot H'}{(\pi \cdot \alpha \cdot t)^{1/2} \cdot K_d} \qquad (1)$$

A discussion of the meaning and value of each of the terms in Equation 1 is provided below.

- Q — Q is the average emission rate ($g/cm^2 \cdot sec$) of a chemical emitted from soil over time period t.
- C_s — C_s is the average concentration of chemical in soil (g/g). The values of C were calculated using the average of all soil depths (surface and subsurface), since the model is intended to describe the process of volatilization from subsurface soils up through surface soils.
- E — E is the soil porosity (dimensionless). It corresponds to the fraction of total soil volume that is not occupied by solid matter. The value of E is calculated from the following equation:

$$E = 1-(\overline{P_s}/P_s) \qquad (2)$$

where:

$\bar{P}_s$ = Average moist bulk soil density (g/cm^3)
P_s = True soil density (the density of the solid matter)(g/cm^3)

The value of P_s is not known, but a value of 2.65 g/cm^3 is typical of most soils (Shen 1981). Since, the value of $\bar{P}_s$ at this site is not known, the default value for E of 0.35, recommended by USEPA (1991), was used.

D_e D_e is the effective diffusivity (cm^2/sec) of each chemical. This characterizes the rate of chemical diffusion up through the pore spaces of the soil. It is calculated from the chemical-specific molecular diffusivity constant D (cm^2/sec) and the soil porosity (E), as follows:

$$D_e = D \cdot E^{1/3} \quad (3)$$

Values of D are available for a few chemicals, but most values must be estimated by extrapolation (Lyman et al. 1982). The equation for estimating D is:

$$D = D' \left[\frac{MW'}{MW} \right]^{1/2} \quad (4)$$

where:

D = The diffusion coefficient of a chemical of concern
D′ = The known diffusion coefficient of a reference chemical
MW = The molecular weight of the chemical of concern
MW′ = The molecular weight of the reference chemical

Lyman et al. (1982) suggest that an appropriate method of estimating D for a chemical of concern is to calculate D values based on two compounds whose diffusion coefficients are known (carbon disulfide and diethyl ether) and average the two D values.

Table A2-1 shows how the values of D were calculated for each of the volatile chemicals of potential concern at this site.

H′ H′ (the nondimensional Henry's law constant) is a chemical-specific term that is calculated from Henry's law constant as follows:

$$H' = H/RT \quad (5)$$

TABLE A2-1 CHEMICAL-SPECIFIC PARAMETERS FOR THE HWANG MODEL

CHEMICAL	MW	Diffusivity (cm2/sec) D1(a)	D2(b)	D (avg)	Koc (c)	H,atm-m3/mol (d)	Kow(e)
Chlorobenzene	113	8.37E-02	7.20E-02	7.78E-02	8.34E+02	3.90E-03	690
Ethylbenzene	106	8.64E-02	7.44E-02	8.04E-02	1.23E+03	6.60E-03	1400
Methyl-2-pentanone, 4-	100	8.89E-02	7.66E-02	8.27E-02	9.21E+01	1.50E-05	12
Methylene chloride	85	9.64E-02	8.30E-02	8.97E-02	7.43E+01	2.00E-03	8.1
Tetrachloroethane, 1,1,2,2-	168	6.86E-02	5.91E-02	6.38E-02	4.80E+02	3.80E-04	250
Tetrachloroethene	166	6.90E-02	5.94E-02	6.42E-02	1.68E+03	2.59E-02	2500
Toluene	92	9.27E-02	7.98E-02	8.63E-02	7.30E+02	6.70E-03	540
Trichloroethane, 1,1,1-	133	7.71E-02	6.64E-02	7.17E-02	5.40E+02	1.44E-02	310
Trichloroethane, 1,1,2-	133	7.71E-02	6.64E-02	7.17E-02	3.07E+02	7.40E-04	110
Trichloroethene	131.5	7.75E-02	6.68E-02	7.22E-02	4.91E+02	9.10E-03	260
Xylenes (total)	106	8.64E-02	7.44E-02	8.04E-02	1.32E+03	7.04E-03	1600

a) Calculated by extrapolation from carbon disulfide (Lyman et al. 1982).
b) Calculated by extrapolation from diethyl ether (Lyman et al. 1982).
c) Calculated from the Kow according to Lyman et al. 1982.
Values from Montgomery and Welkom 1990 or USEPA 1986.
e) Values from USEPA 1992.

where:

H = Henry's law constant (atm-m^3/mol)
R = Gas constant (8.2E-05 atm-m^3/mol-K)
T = Temperature (K)

Table A2-1 shows how the values of H for each of the volatile chemicals of potential concern at this site. At 20 C (293 K), the value of RT is 0.024 atm-m^3/mol, and H' is given by:

$$H' = H/0.024 \quad (6)$$

α α is a term that combines several soil- and chemical-specific parameters, as follows:

$$\alpha = \frac{D_e \cdot E}{E + P_s(1-E)(K_d/H')} \quad (7)$$

The values of D_e, E, P_s, and H' have been discussed above. The value of K_d is discussed below.

K_d K_d is the soil-water partition coefficient (cm^3/g). It is a soil- and chemical-specific term, calculated as follows:

$$K_d = K_{oc} \cdot F_{oc} \quad (8)$$

where:

K_{oc} = Organic carbon binding constant (cm^3/g). Table A2-1 lists values for K_{oc} calculated from the octanol/water partition coefficients according to Lyman et al. (1982) for the volatile chemicals of potential concern at this site.

F_{oc} = Soil organic carbon fraction (unitless). The default value for F_{oc} suggested by USEPA (1991) is 2% (0.02).

t t is the time (seconds) over which the emission rate is averaged. The value of t was chosen to be 6 years (1.9E+08 seconds) for subchronic exposure of children, and 30 years (6.3E+08 seconds) for chronic exposure of adults. Since the emission rate decreases as a function of time, it is assumed that all exposures begin at the present. This approach yields the highest possible exposure rates. For example, any child exposed for 6 years beginning any time in the future would have a lower exposure than for a child exposed now.

TABLE A2-2 HWANG MODEL FOR CALCULATING EMISSION OF VOCs FROM SOIL AND BOX MODEL FOR CALCULATION OF AIR CONCENTRATIONS

PART 1: INPUT SOIL-SPECIFIC VARIABLES

PARAMETER	UNITS	SYMBOL	VALUE
MOIST BULK SOIL DENSITY	g/cm3	P*s	1.7
TRUE PARTICLE DENSITY	g/cm3	Ps	2.65
SOIL POROSITY (1-P*s/Ps)	--	E	0.35
FRACTION ORGANIC CARBON	--	Foc	0.02

PART 2: INPUT CHEMICAL-SPECIFIC VALUES

			CHEMICAL NAME									
			Chloro-benzene	Ethyl-benzene	4-Methyl-2-pentanone	Methylene Chloride	1122-Tetra-chloro-ethane	Tetra-chloro-ethene	Toluene	111-Tri-chloro-ethane	112-Tri-chloro-ethane	Trichloro-ethene	Xylenes
CONC IN SOIL	mg/kg		4.3E-03	2.5E-03	5.0E-03	5.8E-03	2.8E-03	1.5E-02	1.2E-02	4.1E-03	2.8E-03	3.6E-01	2.0E-03
	g/g	Cs	4.3E-09	2.5E-09	5.0E-09	5.8E-09	2.8E-09	1.5E-08	1.2E-08	4.1E-09	2.8E-09	3.6E-07	2.0E-09
DIFFUSION COEFFICENT	cm2/sec	D	7.8E-02	8.0E-02	8.3E-02	9.0E-02	6.4E-02	6.4E-02	8.6E-02	7.2E-02	7.2E-02	7.2E-02	8.0E-02
ORGANIC CARBON BINDING COEFF	mL/g	Koc	8.3E+02	1.2E+03	9.2E+01	7.4E+01	4.8E+02	1.7E+03	7.3E+02	5.4E+02	3.1E+02	4.9E+02	1.3E+03
HENRYS LAW CONSTANT	atm-m3/mol	H	3.9E-03	6.6E-03	1.5E-05	2.0E-03	3.8E-04	2.6E-02	6.7E-03	1.4E-02	7.4E-04	9.1E-03	7.0E-03
DIMENSIONLESS HENRYS CONSTANT	--	H'	1.6E-01	2.8E-01	6.3E-04	8.3E-02	1.6E-02	1.1E+00	2.8E-01	6.0E-01	3.1E-02	3.8E-01	2.9E-01

PART 3: CALCULATED VALUES

EFFECTIVE DIFFUSION COEFF (De = D * E^1/3)	cm2/sec	De	5.48E-02	5.67E-02	5.83E-02	6.32E-02	4.50E-02	4.53E-02	6.08E-02	5.05E-02	5.05E-02	5.09E-02	5.67E-02
SOIL/WATER PARTITION COEFF (Kd = Koc * Foc)	cm3/g	Kd	16.68	2.5E+01	1.842	1.486	9.6E+00	33.6	14.6	10.8	6.14	9.82	26.4
ALPHA (De*E/(E+Ps*(1-E)*Kd/H'))	cm2/sec	ALPHA	1.08E-04	1.28E-04	4.02E-06	7.12E-04	1.51E-05	2.93E-04	2.35E-04	5.64E-04	5.15E-05	3.96E-04	1.28E-04

PART 4: RESULTS OF EMISSION MODEL

			SUBCHRONIC		CHRONIC								
EXPOSURE DURATION	years		6		30								
	sec	t	1.9E+08		9.5E+08								
AVERAGE EMISSION RATE	g/cm2-sec	Q	6.3E-15	4.0E-15	1.4E-15	2.2E-14	1.5E-15	3.7E-14	2.6E-14	1.4E-14	2.8E-15	1.0E-12	3.2E-15
(SUBCHRONIC; 6 YR. AVERAGE)	g/m2-sec	Q	6.3E-11	4.0E-11	1.4E-11	2.2E-10	1.5E-11	3.7E-10	2.6E-10	1.4E-10	2.8E-11	1.0E-08	3.2E-11
	mg/m2-sec	Q	6.3E-08	4.0E-08	1.4E-08	2.2E-07	1.5E-08	3.7E-07	2.6E-07	1.4E-07	2.8E-08	1.0E-05	3.2E-08
AVERAGE EMISSION RATE	g/cm2-sec	Q	2.8E-15	1.8E-15	6.3E-16	1.00E-14	6.7E-16	1.7E-14	1.1E-14	6.2E-15	1.2E-15	4.5E-13	1.4E-15
(CHRONIC; 30 YR AVERAGE)	g/m2-sec	Q	2.8E-11	1.8E-11	6.3E-12	1.00E-10	6.7E-12	1.7E-10	1.1E-10	6.2E-11	1.2E-11	4.5E-09	1.4E-11
	mg/m2-sec	Q	2.8E-08	1.8E-08	6.3E-09	1.00E-07	6.7E-09	1.7E-07	1.1E-07	6.2E-08	1.2E-08	4.5E-06	1.4E-08

PART 5: CALCULATION OF C VALUES USING BOX MODEL

WIDTH (upwind-downwind distance)	m	W	100.0										
AVERAGE WIND SPEED	m/sec	U	4.6										
MIXING HEIGHT (20 - 0.6m)	m	H	11										
AIR CONCENTRATION IN BOX (C = Q*W/(H/2)*U)													
SUBCHRONIC (6 yr average)	mg/m3	C	2.5E-07	1.6E-07	5.6E-08	8.8E-07	6.0E-08	1.5E-06	1.0E-06	5.5E-07	1.1E-07	4.0E-05	1.3E-07
CHRONIC (30 yr average)	mg/m3	C	1.1E-07	7.1E-08	2.5E-08	3.9E-07	2.7E-08	6.6E-07	4.5E-07	2.5E-07	4.9E-08	1.8E-05	5.7E-08

Based on these input parameters, average subchronic and chronic emission rates were calculated from equation 1 for each chemical. These calculations and the resultant values are summarized in Table A2-2 (Parts 1-4).

3.0 BOX MODEL

The concentrations of volatile chemicals in air that result from the soil emission pathway were estimated using a box model (Hanna et al. 1982). The basic equation is:

$$C = \frac{Q \cdot X}{(H/2) \cdot U} \qquad (9)$$

where:

C = concentration in air (mg/m^3)
Q = emission rate (mg/m^2-sec)
X = cross-wind dimension of the box (m)
H = mixing height of the box (m)
U = average windspeed (m/sec) across the box

Values of these parameters were derived as follows:

Q The emission rates were calculated as described in Section 2.0, above.

X The distance from the upwind to downwind edge of the box was estimated to be about 100 m, based on the scale map shown in Figure 1-2.

H The mixing height of the box is a function of distance from the source and turbulence of the air which, in turn, is a function of the roughness of the terrain. The value of H at the upwind edge of the site is zero. At the downwind edge, the value of H was calculated from the following equation (Pasquill 1975):

$$X = 6.25\ Z_0[(H/Z_0)\ \ln\ (H/Z_0) - 1.58\ (H/Z_0) + 1.58] \qquad (10)$$

where:

X = Upwind to downwind distance (m)
Z_0 = Roughness height (m)

The roughness height at the site was estimated to be 0.6 m, based on Cowherd et al. (1985). Employing this value for Z_0 and a value of 100 m for X, the corresponding value of H is 11 m.

U The average wind speed was taken to be 4.6 m/sec, based on wind speed measured at the Detroit Metropolitan Airport.[a]

Employing these input parameters, the concentrations of chemicals in air were calculated as shown in Table A2-2 (Part 5).

4.0 REFERENCES

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(a) Personal communication with Dan Riddle, U.S. National Weather Service, Detroit, 07/06/92.

APPENDIX 3

DETAILED DESCRIPTION OF HIF DERIVATIONS

1.0 BASIC EQUATION AND GENERAL ASSUMPTIONS

As discussed in Section 3.4.2, the basic equation for calculating HIF terms is:

$$HIF = \frac{IR \cdot EF \cdot ED}{BW \cdot AT} \quad (1)$$

where:

IR = Intake Rate. This is the average amount of contaminated medium inhaled or ingested per unit time or event.

BW = Body Weight. This is the average body weight (kg) over the exposure period.

EF = Exposure Frequency. This describes how often exposure occurs per unit time (hr/day, days/yr, events/yr, etc.)

ED = Exposure Duration. This is the total length of time that exposure occurs within the time period of concern (the averaging time). The product of EF and ED gives the total number of days or events that exposure occurred.

AT = Averaging Time. This is the time period over which the average dose is calculated (days).

Table A3-1 summarizes the populations and exposure pathways selected for quantitative analysis in this risk assessment. For each population and exposure pathway, average (AVG) and reasonable maximum (RME) exposure are calculated. For AVG exposure HIFs, the values of parameters are selected to represent the most likely or average exposure conditions. The values for RME variables are selected to represent the highest exposure that could reasonably be expected to occur, but not necessarily the worst case. Thus, average values are selected for some parameters (body weight, skin surface area) and 90 to 95th percentile values are selected where available for other parameters (intake of medium, exposure frequency and duration). Standard assumptions used to evaluate AVG and RME exposures of these populations are as follows.

Body Weight

The average human body weight is 70 kg (154 lb) for adults and 15 kg (33 lb) for children aged 1-6 (USEPA 1991a). The resident youngster is assumed to be aged 7 to 16. The average body weight for this age span is about 43 kg (USEPA 1989b). These values are used for both AVG and RME intake calculations.

TABLE A3-1 LIST OF EXPOSURE SCENARIOS SELECTED FOR QUANTITATIVE EVALUATION

Exposed Population	Exposure Medium	Exposure Route
Current On-Site Worker	Soil	Oral
Hypothetical Future On-Site Residents (Adults, Children)	Yard Soil	Oral
	Groundwater	Oral, Dermal
	Indoor Air (VOCs)	Inhalation
	Vegetables	Oral
	Ambient Air	Inhalation
Hypothetical Future On-Site Residents (Youngsters)	Surface Water	Oral, Dermal
	Sediment	Oral

Exposure Frequency

Residents under both RME and AVG conditions are assumed to be exposed at their residence 350 day/yr (USEPA 1991a). This is based on the assumption that residents are at home for all but a two-week vacation period each year. This is probably an overestimate for adults who work away from home and for school-age children, but is reasonable for pre-school children and for adults who are not employed outside the home. This value is a standard USEPA (1991a) default value and it is not known what percentile of the distribution of exposure frequency values it represents.

Workers are assumed to be exposed 250 days/yr (USEPA 1991a), based on the assumption that the worker works 5 days/week, 50 weeks/year. This is a USEPA default value; the percentile this value represents is unknown. The workers at Hi-Mill are further assumed to be exposed only during the period when the weather is suitable for outdoor lunchtime activity, approximately six months of the year. Therefore, workers are assumed to be exposed 125 days/yr. This value is used for both RME and AVG exposures.

Exposures to resident youngsters at Target Pond are assumed to occur a reasonable maximum of three times a week during the summer months, or 39 exposure events/year. An average exposure is assumed to occur once a week during the summer months (13 exposure events/year; June to August). Since site-specific data are unavailable, exposure frequencies were assumed based on best professional judgment.

Exposure Duration

Residents are assumed to live in their home for an average of 9 years up to a reasonable maximum (90th percentile) of 30 years (USEPA 1989a). Based on this, the RME exposure duration selected for evaluation of chronic and lifetime adult exposures is 30 years; the AVG exposure duration is assumed to be 9 years.

Since children generally have higher intakes of air, water and soil per unit body weight than adults, all HIF terms for a residential child are based on the interval between ages 0 and 6 (i.e., an exposure duration of 6 years). This value is used for both AVG and RME exposures. The resident youngster is also assumed to be exposed for a 10-year period, age 7 to 16 under both AVG and RME exposures.

Workers are assumed to be exposed for a reasonable maximum of 25 years (USEPA 1991a). This is a 95th percentile default value recommended by USEPA (1991a). It is assumed that the average exposure duration is 9 years, equal to the average residence time in one home.

Averaging Time

The averaging times for the populations described above are equal to the exposure duration when evaluating noncarcinogenic health hazards and equal to 70 years when evaluating carcinogenic risks.

2.0 INGESTION OF WATER

2.1 Drinking Water

A reasonable maximum drinking water intake rate (90th percentile) for adult residents is 2 L/day, and for child residents is 1 L/day (USEPA 1989b). An AVG intake rate is 1.4 L/day for adults and 0.6 L/day for children. Based on these intake rates and the values for EF, ED, BW and AT described previously, the HIF terms for ingestion of drinking water are calculated as shown in Table A3-2.

2.2 Surface Water

It is assumed that future residents could swim or play in Target Pond. Ingestion of surface water could occur during these activities. The USEPA (1989a) reports that an average of 0.05 L/hr of water could be consumed while swimming. The USEPA (1992) also recommends both average (0.5 hr) and upper-bound (1.0 hr) estimates of the event time. Thus, it is assumed that during each swimming/playing event at Target Pond 0.05 L/hr of water could be incidentally ingested by youngsters during an exposure event lasting 0.5 (AVG) or 1.0 (RME) hr. Based on these values, the HIF terms for ingestion of surface water are calculated as shown in Table A3-3.

3.0 INGESTION OF SEDIMENTS

No data were located on the amount of sediment an individual could ingest during swimming or playing in Target Pond. In the absence of data, a reasonable maximum value of 100 mg/event for a youngster is assumed, based on activities (catching frogs or other amphibians, digging along the edge of the pond, etc.) during which contact with the sediments is likely to occur. For average exposures a value of 50 mg/event (one-half the RME value) was assumed. Based on these values, the HIFs for ingestion of sediments by the future resident youngster are shown in Table A3-4.

4.0 INGESTION OF SOIL

Available data on soil intake by humans under typical residential conditions indicate that most soil intake is by hand-to-mouth contact and that intake decreases as a function of age. The reasonable maximum soil intake by residential children less than 6 years of age is estimated to be 200 mg/day (2E-04 kg/day) (USEPA 1989a) and the average intake is about 100 mg/day (USEPA 1991b) or one-half the RME intake. While it is true some children ingest considerably more (pica behavior), this is believed to be uncommon and is not considered in calculating an HIF. A residential adult RME ingestion rate is about 100 mg/day (1E-04 kg/day) (USEPA 1989a). The average rate is assumed to be one-half the RME value, 50 mg/day, assuming the same ratio of RME and AVG intakes as the child, since no data were located on average adult soil intake levels. To account for the fact that some adults may begin exposure as a child, the RME soil ingestion rate for the adult is calculated as a time-weighted-average over the first 30 years of life, assuming an ingestion rate of 200 mg/day for a 15-kg child for 6 years and an ingestion rate of 100 mg/day for a 70-kg adult for 24 years (USEPA 1991a). This will

TABLE A3-2 QUANTIFICATION OF EXPOSURE FROM INGESTION OF DRINKING WATER

Basic Equation: $HIF = (IR \cdot EF \cdot ED)/(BW \cdot AT)$

Where:

HIF = Human intake factor (L/kg-day)
IR = Drinking water intake rate (L/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

Assumed values for exposure parameters:

Exposure Parameter	RME		AVG	
	Child (1-6 yr)	Adult	Child (1-6 yr)	Adult
IR	1 L/day[a]	2 L/day[b]	0.6 L/day[a]	1.4 L/day[a]
EF	350 days/yr[b]	350 days/yr[b]	350 day/yr[b]	350 day/yr[b]
ED	6 years[b]	30 years[b]	6 years[b]	9 years[b]
BW	15 kg[a]	70 kg[b]	15 kg[a]	70 kg[b]
AT (Noncancer)	2,190 days	10,950 days	2,190 days	3,285 days
AT (Cancer)	25,550 days	25,550 days	25,550 days	25,550 days
HIF_S	6.4E-02 L/kg-day	--	3.8E-02 L/kg-day	--
HIF_C	--	2.7E-02 L/kg-day	--	1.9E-02 L/kg-day
HIF_L	5.5E-03 L/kg-day	1.2E-02 L/kg-day	3.3E-03 L/kg-day	2.5E-03 L/kg-day

(a) Exposure Factors Handbook (USEPA 1989b).
(b) Standard Factors Guidance (USEPA 1991a).

TABLE A3-3 QUANTIFICATION OF EXPOSURE FROM INGESTION OF SURFACE WATER

Basic Equation: $HIF = (IR \cdot ET \cdot EF \cdot ED)/(BW \cdot AT)$

Where:

HIF = Human intake factor (L/kg-day)
IR = Surface water intake rate (L/day)
ET = Exposure time (hr/event)
EF = Exposure frequency (events/yr)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

Assumed values for exposure parameters:

Exposure Parameter	Resident Youngster (7-16 yr) RME	Resident Youngster (7-16 yr) AVG
IR	5E-02 L/hr[a]	5E-02 L/hr[a]
ET	1.0 hr[b]	0.5 hr[b]
EF	39 events/yr[c]	13 events/yr[c]
ED	10 yr[c]	10 yr[c]
BW	43 kg[d]	43 kg[D]
AT (Noncancer)	3,650 days	3,650 days
AT (Cancer)	25,550 days	25,550 days
HIF_C	1.2E-04 L/kg-day	2.1E-05 L/kg-day
HIF_L	1.8E-06 L/kg-day	3.0E-06 L/kg-day

(a) Risk Assessment Guidance for Superfund (USEPA 1989a).
(b) Dermal Guidance (USEPA 1992).
(c) Assumed value--see text for discussion.
(d) Exposure Factors Handbook (USEPA 1989b).

TABLE A3-4 QUANTIFICATION OF EXPOSURE FROM INGESTION OF SEDIMENT

Basic Equation: $HIF = (IR \cdot CF \cdot EF \cdot ED)/(BW \cdot AT)$

Where:

HIF = Human intake factor (kg/kg-day)
IR = Sediment intake rate (mg/event)
CF = Conversion factor (kg/mg)
EF = Exposure frequency (events/year)
ED = Exposure duration (years)
BW = Body weight (kg)
AT = Averaging time (days)

Assumed values for exposure parameters:

Exposure Parameter	Resident Youngster (7-16 yr) RME	Resident Youngster (7-16 yr) AVG
IR	100 mg/event[a]	50 mg/event[a]
CF	1E-06 kg/mg	1E-06 kg/mg
EF	39 events/yr[a]	13 events/yr[a]
ED	10 years[a]	10 years[a]
BW	43 kg[b]	43 kg[b]
AT (Noncancer)	3,650 days[c]	3,650 days
AT (Cancer)	25,550 days[c]	25,550 days
HIF_S	--	--
HIF_C	2.5E-07 kg/kg-day	4.1E-08 kg/kg-day
HIF_L	3.5E-08 kg/kg-day	5.9E-09 kg/kg-day

(a) Assumed value based on best professional judgment; see text for discussion.
(b) Exposure Factors Handbook (USEPA 1989b).
(c) Standard Factors Guidance (USEPA 1991a).

overestimate exposure of an adult who is not exposed as a child. For the AVG adult exposure, it is assumed that the nine-year residence period is during adulthood so time-weighting is unnecessary.

Soil intake for an industrial worker is estimated at 50 mg/day at work (USEPA 1991a). While this value is a representative reasonable maximum for a indoor worker, it is assumed that it is also valid for an individual who spends time outdoors engaging in recreational activity (picnicking or playing frisbee) during the work day. As for the residential populations, ingestion rate of one-half the reasonable maximum value is assumed for average exposures (i.e., 25 mg/day).

Using the assumptions and estimates described above, the HIF values for ingestion of soil are calculated as shown in Table A3-5.

5.0 INGESTION OF HOMEGROWN VEGETABLES

Available data on intake of foods indicates that adults consume about 200 g/day of vegetables from all sources (USEPA 1991). Children are generally assumed to consume about half as much as adults (100 g/day). The fraction of vegetables consumed that are homegrown is 0.4 for RME exposure (USEPA 1991a) or 0.25 for AVG exposure (USEPA 1989b).

Based on these values, the HIFs for ingestion of homegrown vegetables are shown in Table A3-6.

6.0 DERMAL EXPOSURES TO CHEMICALS IN WATER

Humans absorb chemicals from household water across the skin during showering or bathing or from outdoor surface waters while wading or playing. The equation for calculating the HIF for dermal exposure is slightly different from the basic equation (1) and is as follows:

$$HIF\ (L/kg\text{-}day) = \frac{SA \cdot PC \cdot ET \cdot EF \cdot ED \cdot CF}{BW \cdot AT} \qquad (2)$$

where:

HIF = Human Intake Factor (L/kg-day)
SA = Skin Surface Area Available for Contact (cm^2)
PC = Chemical-Specific Dermal Permeability Constant (cm/hr)
ET = Exposure Time (hours/day)
EF = Exposure Frequency (days/year)
ED = Exposure Duration (years)
CF = Volumetric Conversion Factor for Water (1 L/1,000 cm^3)
BW = Body Weight (kg)
AT = Averaging Time (days)

APPENDIX 4

TOXICOLOGICAL SUMMARIES FOR THE CHEMICALS OF CHIEF CONCERN AT THE HI-MILL SITE

1.0 ANTIMONY

1.1 Noncarcinogenic Effects

Both human occupational and animal studies provide evidence for respiratory effects by antimony compounds following inhalation exposure. Pneumoconiosis has been observed in humans exposed by acute and chronic inhalation to antimony at atmospheric concentrations ranging from 0.08 to 75 mg/m^3 (USEPA 1980). Occupational exposures of 2.15 mg/m^3 antimony as antimony trisulfide have produced increased blood pressure and altered EKG readings in humans (ATSDR 1990). In animals, increased macrophage proliferation and activity, myocardial pulmonary fibrosis and certain types of pneumonia have been observed after inhalation exposure to antimony at concentrations typically ranging from 45 to 125 mg/m^3 (USEPA 1980). To date, the USEPA has not determined an RfC for inhalation of antimony (USEPA 1992).

Oral administration of therapeutic doses of antimony to humans has been associated with nausea, vomiting, skin rashes, myocardial symptoms and hepatic necrosis following ingestion of doses typically ranging from 0.4 to 2.1 mg/kg/day (USEPA 1980). Consistent with observations in humans, animal studies have yielded data showing myocardial damage from oral ingestion of high doses of antimony. A decreased hypotensive response and decreased maternal weight gain have been noted in rats following subchronic oral doses as low as 0.075 mg/kg/day (ATSDR 1990). Schroeder et al. (1970) reported that rats exposed to 5 ppm (0.35 mg/kg/day) of potassium antimony tartrate via drinking water had significantly shortened lifespans, significantly lower glucose levels and significant variations in serum cholesterol levels. This study was the basis on which USEPA (1992) derived a chronic oral RfD of 4E-04 mg/kg/day. A LOAEL of 0.35 mg/kg/day and an uncertainty factor of 1,000 (to account for interspecies and intraspecies variability and the use of a LOAEL) were used to derive the oral RfD. Confidence in the chosen study is rated as low because only one species and one dose level were used, no-observed-effect level (NOEL) was determined and gross pathology and histopathology were not well described (USEPA 1992).

1.2 Carcinogenic Effects

There is insufficient evidence to determine the carcinogenicity of antimony. Inhalation studies with 4.2 to 36 mg/m^3 antimony trioxide in rats provided only qualitative evidence of lung cancer (USEPA 1980). Other inhalation studies using 3.8 to 4.2 mg/m^3 antimony were negative for carcinogenicity in rats and pigs (ATSDR 1990). Schroeder et al. (1970) administered 5 ppm of potassium antimony tartrate in drinking water to rats from weaning until natural death and concluded antimony was not tumorigenic. Antimony has not been evaluated by the USEPA for evidence of carcinogenic potential (USEPA 1992).

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2.0 ARSENIC

Arsenic toxicity depends upon its chemical form. In general, compounds containing As(+3) (arsenites) have somewhat higher acute toxicity than compounds as As(+5) (arsenates) (ATSDR 1991, USEPA 1984). Readily soluble arsenic compounds tend to be somewhat more toxic than poorly soluble forms. However, conversions in valence state and solubility may occur both in the environment and in the body (USEPA 1988), so oxidation state is usually not a critical consideration in evaluating the toxicity of arsenic compounds.

2.1 Noncarcinogenic Effects

Inhalation exposure to arsenic compounds in air can produce skin changes, vascular injury and gastrointestinal irritation, but the effects are usually very mild. The chief effect is usually irritation to the skin and mucous membranes of the eyes, nose and throat (ATSDR 1991). Occupational exposure levels producing these effects range from 0.05 to 0.5 mg/m^3 (ATSDR 1991). For example, skin darkening and corns have been noted in workers who were exposed chronically to airborne levels of about 0.4 mg/m^3 (Perry et al. 1948), while levels of 0.1 to 0.2 mg/m^3 have been reported to cause mild skin irritation (Pinto and McGill 1953). Blom et al. (1985) concluded the risk of neurological effects is minimal at exposure levels of 0.05 mg/m^3, and ATSDR (1991) has estimated that the effects of arsenic in air are minor at exposure levels of 0.1 to 1 mg/m^3. In mice, exposure to 0.5 to 0.9 mg/m^3 produced injury to alveolar macrophages (ATSDR 1991). The USEPA has not developed an inhalation RfC for arsenic (USEPA 1992).

Oral exposure to high doses of arsenic produces marked irritation of the gastrointestinal tract, leading to nausea and vomiting. Symptoms of chronic ingestion of lower levels of arsenic often begin with a vague weakness and nausea. As exposure continues, symptoms become more characteristic and include diarrhea, vomiting, decreased blood cell formation, injury to blood vessels, damage to kidney and liver and impaired nerve function that leads to "pins and needles" sensations in the hands and feet. The most diagnostic sign of chronic arsenic exposure is an unusual pattern of skin abnormalities, including dark and white spots and a pattern of small "corns," especially on the palms and soles (ATSDR 1991)

The average daily intake of arsenic that produces these effects varies from person to person. In a large epidemiological study, Tseng et al. (1968) reported skin and vascular lesions in humans exposed to 0.014 mg/kg/day or more arsenic through the drinking water in Taiwan. These effects were not observed in a control population ingesting 0.0008 mg/kg/day.

The USEPA and the NOAEL of 0.0008 mg/kg/day for skin and vascular lesions (Tseng et al., 1968) to derive an oral RfD of 3.0E-04 mg/kg/day (USEPA 1992). The NOAEL was divided by an uncertainty factor of 3 to account for a lack of reliable data on reproductive effects and the possibility that sensitive human

subgroups may not have been identified. Confidence in the RfD is rated medium. A higher rating was not given due to uncertainties in dose estimates and other problems in the epidemiological data base (USEPA 1992).

2.2 Carcinogenic Effects

Lung Cancer

There have been a number of epidemiological studies in humans which indicate that chronic inhalation exposure to arsenic is associated with increased risk of lung cancer (USEPA 1984, ATSDR 1991). As with many epidemiological studies, confounding factors such as smoking and exposure to other lung carcinogens may complicate data interpretation, but the consistent findings among studies constitute convincing evidence that arsenic does increase lung cancer incidence. Increased lung cancer risk has been reported most frequently in smelter workers exposed to predominantly As(+3) (e.g., Lee and Fraumeni 1969). Increased incidence of lung cancer also has been reported in worker populations exposed mainly to As(+5) (Ott et al. 1974). Based on the combined results of five separate risk estimates at two separate smelter facilities, the USEPA 1992 has calculated a geometric-mean unit risk of 4.29E-3 $(mg/m^3)^{-1}$ corresponding to an inhalation slope factor of 15 $(mg/kg/day)^{-1}$.

Skin Cancer

There is strong evidence from a number of human studies that oral exposure to arsenic increases the risk of skin cancer (USEPA 1984, ATSDR 1991). The most common type of cancer is squamous cell carcinoma, which appears to develop from some skin corns. In addition, basal cell carcinoma may also occur, typically arising from cells not associated with the corns. Although these cancers may be easily removed, they can be painful and disfiguring and can be fatal if left untreated.

The amount of arsenic ingestion that leads to skin cancer is controversial. Based on a study of skin cancer incidence in Taiwanese residents exposed mostly to As(+3) in drinking water (Tseng et al. 1968, USEPA 1984), the USEPA has calculated a unit risk of 5E-5 $(\mu g/L)^{-1}$ corresponding to an oral slope factor of 1.75 $(mg/kg/day)^{-1}$ (USEPA 1992). This study has been criticized on several grounds, including uncertainty about exposure levels, possible effects of poor nutrition in the exposed population, potential exposure to other substances besides arsenic and lack of blinding in the examiners. Consequently, some quantitative uncertainty exists in the cancer potency factor derived from the Tseng data. Nevertheless, these criticisms do not challenge the fundamental conclusion that arsenic ingestion is associated with increased risk of skin cancer, and the Tseng study is considered to be the best study currently available for quantitative estimation of skin cancer risk (USEPA 1988).

Other Cancers

Although the evidence is limited, there are some reports which indicate that chronic oral arsenic exposure may increase risk of internal cancers, including cancer of the liver, bladder and lung (Chen et al. 1985, 1986, 1988a, 1988b). This is supported by limited evidence that inhalation exposure may also

increase risk of gastrointestinal, renal or bladder cancers (Lee-Feldstein 1983, Enterline and Marsh 1982a).

Threshold Versus Nonthreshold Model of Arsenic Carcinogenicity

Most carcinogens are considered to act through a nonthreshold mechanism whereby no dose except zero is without risk of cancer. Some researchers have suggested that low doses of arsenic may be partially detoxified by in vivo methylation, possibly leading to a threshold dose below which cancer will not occur (Marcus and Rispin 1988). Although there are data which are consistent with this view, the USEPA has reviewed the available information (USEPA 1992) and has concluded that the data are insufficient at present to establish that there is a threshold for arsenic-induced cancer.

2.3 Beneficial Effects

Several studies in animals suggest that low levels of arsenic in the diet may be beneficial for reproduction and normal postnatal development (Schwartz 1977, Anke et al. 1978, 1987, Uthus et al. 1983). However, these studies were not well controlled, and some researchers believe the data are not adequate to show that arsenic is beneficial (Solomons 1984, Hindmarsh and McCurdy 1986). The USEPA (1988) has reviewed the evidence and concluded that the essentiality of low levels of arsenic in animals has not been established but is plausible.

If arsenic is beneficial or essential in animals, it is also likely to be so for humans. Based on the animal data, the estimated beneficial dose for humans is approximately 10 to 50 µg/day (USEPA 1988). This level of arsenic intake is usually provided in a normal diet, and no cases of arsenic deficiency in humans have been reported (ATSDR 1991).

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3.0 1,2-DICHLOROETHENE (TOTAL)

1,2-Dichloroethene exists in two isomeric forms: cis and trans. Because the site analysis does not inidcate detection of one specific isomer, this summary will consider the health effects resulting from exposure to either isomer and to mixtures of the cis and trans isomers.

3.1 Noncarcinogenic Effects

Very limited data are available regarding animal or human health effects following exposure to either cis or trans 1,2-dichloroethene. Two human studies have been located in the available literature (ATSDR 1989). One of these studies reports a human fatality resulting from inhalation exposure to 1,2-dichloroethene in an unvented area. Information about the concentration or isomeric form of the 1,2-dichloroethene was not provided nor was any information available about the toxic effects leading to death. In another case, a five to ten minute exposure to a solution containing 4.8 to 8.8 mg/L trans 1,2-dichloroethene resulted in nausea, vertigo and drowsiness in two human subjects. However, it is not clear whether the isomer was pure, whether the subjects were breathing an aerosol or a gas or the actual dose inhaled (ATSDR 1989).

Serious effects seen in rats following an 8 hour exposure to 200 to 3,000 ppm 1,2-dichloroethene included capillary hyperemia in the lungs (1,000 ppm) and enlarged hearts (3,000 ppm) (ATSDR 1989). Inhalation exposure in rats to 200 ppm for 16 weeks resulted in liver degeneration and pulmonary infiltration. A reference does for inhalation exposure to trans 1,2-dichloroethene is not now available from USEPA (1992).

No studies were located in the available literature regarding oral exposure of humans to cis- or trans-1,2-dichloroethene (ATSDR 1989). Acute ingestion of 1,000 mg/kg trans 1,2-dichloroethene was lethal in both rats and mice (ATSDR 1989). Toxic effects observed included damage to respiratory tissues, central nervous system depression and fatty degeneration of the liver. Longer-term exposures (14 to 90 days) to 200 to 3,000 mg/kg-day of the trans isomer in drinking water resulted in no observed effects in rats (ATSDR 1989).

In rats administered 32 mg/kg-day cis-1,2-dichloroethene by gavage for 90 days hemoglobin and hematocrit were significantly decreased (McCauley et al. n.d.). The USEPA uses this study to derive a chronic oral RfD of 1E-1 mg/kg-day (USEPA 1991). The LOAEL was divided by an uncertainty factor of 3,000 and although the RfD is verified its input into IRIS is pending (USEPA 1991).

The USEPA uses the study by Barnes et al. (1985) in deriving a chronic oral RfD. In this study, male and female mice received 17, 175 or 387 mg/kg-day

(males) or 23, 224 or 452 mg/kg-day (females) trans 1,2-dichloroethene in drinking water for 90 days. No adverse effects were observed in either sex at any dose level. However, serum alkaline phosphatase levels were significantly elevated in male mice receiving 175 and 387 mg/kg-day. Based upon a LOAEL of 175 mg/kg-day and a NOAEL of 17 mg/kg-day identified by the Barnes study and supported by the observed decrease of antibody forming cells in male mice at 175 and 387 mg/kg-day (90-day study) (Shopp et al. 1985) the USEPA has derived a chronic oral RfD of 2E-2 mg/kg-day using an uncertainty factor of 1,000 (USEPA 1992). The same study was used to a subchronic oral RfD of 2E-1 using an uncertainty factor of 100 (USEPA 1991). The USEPA (1992) rates the confidence in this oral RfD as low due to lack of chronic studies and lack of data on reproductive and developmental toxicity.

3.2 Carcinogenic Effects

No studies were located in the available literature regarding cancer effects in humans or animals exposed to 1,2-dichloroethene by the inhalation, oral or dermal routes (ATSDR 1989). Trans 1,2-dichloroethene has not been evaluated by the USEPA for evidence of carcinogenic potential (USEPA 1992).

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4.0 NITRATE/NITRITE

Nitrate and nitrite are naturally occurring inorganic ions. Nitrate can be converted to nitrite in the body, particularly by bacteria in the alimentary canal. Therefore, the effects of these two ions are discussed together.

4.1 Noncarcinogenic Effects

Data concerning the toxicity of inhaled nitrate or nitrite in humans or animals were not located.

Studies in humans and animals indicate that the chief adverse effect of nitrate and nitrite is the production of methemoglobinemia. Nitrate must first be converted to nitrite to produce this effect. Nitrite oxidizes the Fe^{+2} form of iron in hemoglobin to Fe^{+3}, forming methemoglobin. Methemoglobin can not bind oxygen normally, therefore the oxygen-carrying capacity of the blood is reduced. Typical blood levels of methemoglobin range from 0.5 to 2%. Levels below 10% are not associated with any adverse effects. Levels above 10% may result in cyanosis whereas levels as high as 25% can produce weakness, rapid pulse and tachypnea (USEPA 1992).

Infants appear to be particularly sensitive to the methemoglobin-forming effects of nitrate. This sensitivity is due to a higher pH in the stomach of infants which allows for a larger bacteria population (USEPA 1990). Bosch et al. (1950) evaluated 139 cases of cyanosis in children (8 days to 5 months old) caused by nitrate contaminated wells. All wells contained greater than 10 mg/L nitrate-nitrogen. In 214 cases of infantile methemoglobinemia, Walton et al. (1951) reported all were due to consumption of water with levels of 11 mg/L or more nitrate-nitrogen. Based on estimates of accidental exposures, older children and adults require doses of 8 to 12 mg/kg nitrite-nitrogen to produce methemoglobinemia (USEPA 1990). Two epidemiological studies reported an increased risk of birth defects (2.3 to 2.8) in subpopulation with elevated levels of nitrate in the drinking water (5 to 15 mg/L and 1.3 to 26 ppm) (USEPA 1990).

In rats and oral doses of 40 to 80 mg/kg/day nitrate or nitrite-nitrogen resulted in methemoglobinemia. Pregnant rats may be more susceptible since a single dose of 0.5 to 6 mg/kg nitrite-nitrogen was sufficient to produce up to 60% methemoglobin (USEPA 1990). Altered thyroid weight and function has been observed in rats and pigs at higher doses of nitrate-nitrogen. Nitrite has also produced a reduction in life span and damage to the liver, lung, spleen, kidney and adrenals of mice or rats (USEPA 1990). In general, doses of 2 to 10 mg/kg/day nitrite-nitrogen did not result in any developmental or reproductive effects in animals. However, higher doses (12 to 90 mg/kg/day nitrite-nitrogen) have resulted in decreased reproduction and sperm abnormalities in the parents, and increased mortality, decreased body weight, liver and spleen damage and anemia in their offspring. A few studies have noted behavioral changes in the offspring at doses as low as 1.7 mg/kg/day nitrate-nitrogen or 2.5 mg/kg/day nitrite-nitrogen (USEPA 1990).

The USEPA has calculated an oral RfD of 1.6+0 mg/kg/day for nitrate-nitrogen and 1E-1 mg/kg/day for nitrite-nitrogen (USEPA 1992). These values are based on the NOAEL of 10 mg/L nitrate-nitrogen for infantile methemoglobinemia as reported by Bosch et al. (1950) and Walton (1951). The NOAEL was adjusted for daily water intake (0.64-1 L) and infant body weight (4 to 10 kg). The use of an uncertainty factor was not necessary since the critical studies identified the NOAEL in the most sensitive human subpopulation, however, a modifying factor of 10 was used for nitrite-nitrogen to account for the direct toxicity of nitrite. Confidence in these values is rated high since there are a large number of good supporting human and animal studies (USEPA 1992).

4.2 Carcinogenic Effects

By themselves, studies on the carcinogenicity of nitrate or nitrite have been negative or equivocal. The primary reason for concern regarding carcinogenicity lies in the ability of the nitrite to react with secondary and

tertiary amines (commonly found in the diet) to form carcinogenic nitroamines. A number of animal studies have shown that nitrite, when fed concurrently with a nitrosatable amine, yields an increased incidence of tumors in a number of tissues including the lungs, esophagus, stomach, tongue, nasal cavity and liver (USEPA 1990). A carcinogenicity assessment is currently listed as pending in IRIS (USEPA 1992).

4.3 References

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5.0 TRICHLOROETHENE

5.1 Noncarcinogenic Effects

Inhalation exposure of humans to trichloroethene (TCE) has resulted in effects on the central nervous system, liver, kidney and hematological system. Deaths have been reported following acute accidental exposure to TCE in the workplace, although quantitative estimates of exposure are not available (ATSDR 1991). Inhalation exposure to 27 ppm resulted in drowsiness and irritation to the mucous membranes. Central nervous system effects (headaches and changes in behavior/performance tests) are seen beginning at 80 to 100 ppm in humans and animals. Hepatic and renal effects (increased organ weights and histopathology) occur at somewhat higher exposures in humans (ATSDR 1991).

Subchronic inhalation exposure to 55 ppm resulted in increased liver weight in rats, but 35 ppm did not cause observable injury to rats, rabbits, guinea pigs, monkeys or dogs (ATSDR 1991). Kidney weights were increased after exposure to 75 ppm. Inhalation exposure of mice and rats to 300 ppm during pregnancy resulted in no treatment-related increase in malformations (ATSDR 1991). Hematological effects such as altered hemoglobin levels and myelotoxic anemia have been reported at higher exposures in animals. USEPA has not derived an inhalation RfD for TCE (USEPA 1991), and ATSDR considers it inappropriate to derive an inhalation minimal risk level (MRL) since the LOAEL for CNS effects in humans following acute exposure to TCE is lower than the NOAELs for subchronic and chronic exposures in animals (ATSDR 1991).

Numerous cases of human fatality from oral intake of TCE have been recorded in the literature (ATSDR 1991). Acute oral intake of 1,043 mg/kg has been reported as the fatal dose for humans. Other effects from oral exposure to

TCE include enlarged kidney and impaired renal function. No dose-response data are available on the renal and hepatic effects of TCE in humans. In mice, liver weights were increased after oral doses of 500 to 1,200 mg/kg/day. Renal function, as indicated by urinary ketone and protein levels, was impaired in mice at doses of 393 mg/kg/day, but not at 250 mg/kg/day (ATSDR 1991). USEPA has not derived an oral RfD for TCE (USEPA 1991), but ATSDR calculated a subchronic oral MRL of 2.5 mg/kg/day based on renal effects (ATSDR 1991).

5.2 Carcinogenic Effects

Human epidemiological studies do not provide clear evidence of a causal relationship between TCE exposure and increased risk of cancer. Inhalation exposure to TCE in the workplace has been associated with increased rates of bladder cancer and lymphoma, and oral exposure has been linked to increased incidence of leukemia. However, lack of adequate exposure data, small sample sizes and concurrent exposure to other chemicals limit the findings of these reports (ATSDR 1989).

Animal studies indicate that TCE is carcinogenic in mice and rats. Inhalation and/or oral exposure resulted in lung and liver tumors in mice and kidney and testicular tumors in rats (ATSDR 1991). The USEPA (1991) calculated an inhalation unit risk of 1.7E-6 $(\mu g/m^3)^{-1}$, based on two inhalation studies (Maltoni et al. 1986, Fukuda et al. 1983) which found lung adenomas in mice. This corresponds to an inhalation slope factor of 6E-2 $(mg/kg/day)^{-1}$, assuming inhalation of 20 m^3/day by a 70-kg human.

Based upon the results to two comprehensive studies (NCI 1976, NTP 1983) finding increased incidence of hepatocellular carcinomas in male and female mice following chronic exposure (by gavage) to TCE, an oral slope factor of 1.1E-02 $(mg/kg/day)^{-1}$ was derived (USEPA 1991). These slope factor values have been withdrawn and new ones are in preparation by a USEPA workgroup (USEPA 1992).

5.3 References

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6.0 VINYL CHLORIDE

6.1 Noncarcinogenic Effects

Most of the health effects information about human exposure to vinyl chloride comes from occupational exposure to vinyl chloride vapors in air. However, few dose-response data are available. Deaths in humans have been reported as the result of acute inhalation exposure to very high (although uncertain) concentrations of vinyl chloride. Longer-term inhalation exposures to lower concentrations (no quantitative dose information) have resulted in severe damage to lung and liver tissue, central nervous system and skin abnormalities and decreased peripheral circulation. These signs and symptoms when present in an individual exposed to vinyl chloride are collectively referred to as "vinyl chloride disease" (ATSDR 1991).

Deaths in rats and guinea pigs have been observed following acute exposure of vinyl chloride at concentrations in excess of 100,000 ppm (ATSDR 1991). Acute inhalation exposure to high doses (50,000 to 70,000 ppm) of vinyl chloride resulted in narcosis and other central nervous system effects in dogs and rats. Intermittent exposures for periods of 6 to 12 months to concentrations of 1,000 ppm resulted in decreased survival in both rats and mice (ATSDR 1991). Short-term exposure to 1,000 ppm resulted in acute hepatotoxicity in mice (ATSDR 1991).

Effects of oral exposure to vinyl chloride in humans have not been reported and there are only very limited oral data from animal studies. The target organ for animals ingesting vinyl chloride is the liver (ATSDR 1988g). A 13-week gavage study in rats identified a NOAEL of 30 mg/kg-day and a LOAEL for hepatotoxicity of 300 mg/kg-day. A chronic study of vinyl chloride toxicity in rats identified a NOAEL of 0.13 mg/kg-day and a LOAEL for hepatotoxicity of 1.3 mg/kg-day (ATSDR 1991). No chronic oral RfD has been derived for vinyl chloride (USEPA 1992).

6.2 Carcinogenic Effects

Epidemiological studies of workers exposed to vinyl chloride indicate a clear association between inhalation exposure and increased risk of cancer of the liver, brain, lung and other sites (Maltoni et al. 1980, 1981). This is supported by numerous studies in animals. For this reason, vinyl chloride has been classified as a Group A carcinogen: human carcinogen (USEPA 1991).

In studies by Maltoni et al. (1981) rats, mice and hamsters were exposed for 30 to 52 weeks to vinyl chloride in air. Concentrations ranged from one to 30,000 ppm. Statistically significant increases in the incidences of liver angiosarcomas were observed in all three species at exposure levels >50 ppm. Several other studies including those of Suzuki (1981), have associated inhalation exposure to vinyl chloride with increased incidence of lung cancer in animals (ATSDR 1991).

Based upon the statistically significant increase in the incidence of liver angiosarcomas resulting from inhalation exposure to vinyl chloride in male and female rats, a slope factor of 2.95E-1 $(mg/kg\text{-}day)^{-1}$ has been derived by USEPA (1992). This slope factor has been verified and its input into IRIS is pending (USEPA 1991).

A lifetime study in rats examined the carcinogenicity dietary exposure to vinyl chloride (Feron et al. 1981). Rats received vinyl chloride at doses of 1.8 to 17 mg/kg-day. Lifetime exposure to 1.8 mg/kg-day vinyl chloride resulted in significantly increased incidence of neoplastic liver nodules and/or hepatocellular carcinoma. Based upon this study, the USEPA has derived a slope factor of 1.9E+0 $(mg/kg\text{-}day)^{-1}$ (USEPA 1991).

6.3 References

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APPENDIX 5

DETAILED CALCULATIONS OF EXPOSURE AND RISK AT THE HI-MILL SITE

The worksheets in this Appendix present the detailed risk calculations for all pathways evaluated at the Hi-Mill site. The worksheets are organized as follows:

RANGE NAME: CTv

LIST OF CHEMICALS OF CONCERN
WITH CTVs AND OTHER CHEMICAL-SPECIFIC DATA

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 1 (RME)
FILE NAME: DATA
LAST UPDATED: 10/27/92

		ORAL				INHALATION			DERMAL(a)				
NO.	CHEMICAL NAME	RfDo	RfDc	SF	AFo	RfDo	RfDc	SF	RfDo	RfDc	SF	ABS	P
1	Aluminum	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	1.0E-03
2	Antimony	4.0E-04	4.0E-04	NA	1.0E-01	NA	NA	NA	4.0E-05	4.0E-05	NA	NA	1.0E-03
3	Arsenic	3.0E-04	3.0E-04	1.8E+00	1.0E+00	NA	NA	1.5E+01	2.9E-04	2.9E-04	1.8E+00	NA	1.0E-03
4	Barium	7.0E-02	7.0E-02	NA	1E-01	1.4E-03	1.4E-04	NA	7.0E-03	7.0E-03	NA	NA	1.0E-03
5	Beryllium	5.0E-03	5.0E-03	4.3E+00	5.0E-03	NA	NA	8.4E+00	2.5E-05	2.5E-05	8.6E+02	NA	1.0E-03
6	Cadmium (food)	NA	1.0E-03	NA	3E-02	NA	NA	6.3E+00	NA	2.5E-05	NA	NA	NA
7	Chromium	2.0E-02	5.0E-03	NA	5E-02	NA	NA	4.2E+01	1.0E-03	2.5E-04	NA	NA	1.0E-03
8	Cobalt	NA	NA	NA	3E-01	NA	NA	NA	NA	NA	NA	NA	1.0E-03
9	Copper (b)	3.7E-02	3.7E-02	NA	5.0E-01	NA	NA	NA	1.9E-02	1.9E-02	NA	NA	1.0E-03
10	Lead	NA	NA	NA	2E-01	NA	NA	NA	NA	NA	NA	NA	1.0E-03
11	Mercury	3.0E-04	3.0E-04	NA	2E-02	NA	NA	NA	6.0E-06	6.0E-06	NA	NA	1.0E-03
12	Nickel	2.0E-02	2.0E-02	NA	5E-02	NA	NA	8.4E-01	1.0E-03	1.0E-03	NA	NA	1.0E-03
13	Silver	5.0E-03	5.0E-03	NA	5E-02	NA	NA	NA	2.5E-04	2.5E-04	NA	NA	1.0E-03
14	Vanadium	7.0E-03	7.0E-03	NA	1E-02	NA	NA	NA	7.0E-05	7.0E-05	NA	NA	1.0E-03
15	Cyanide	2.0E-02	2.0E-02	NA	1E+00	NA	NA	NA	2.0E-02	2.0E-02	NA	NA	1.0E-03
16	Ammonia-N	9.7E-01	9.7E-01	NA	1.0E+00	2.9E-02	2.9E-02	NA	9.7E-01	9.7E-01	NA	NA	1.0E-03
17	Nitrate+Nitrite	1.0E-01	1.0E-01	NA	1E+00	NA	NA	NA	1.0E-01	1.0E-01	NA	NA	1.0E-03
18	Acetone	1.0E+00	1.0E-01	NA	1.0E+00	NA	NA	NA	1.0E+00	1.0E-01	NA	NA	5.7E-04
19	Bromodichloromethane	2.0E-02	2.0E-02	1.3E-01	1.0E+00	NA	NA	NA	2.0E-02	2.0E-02	1.3E-01	NA	5.0E-03
20	Butanone, 2-	5.0E-01	5.0E-02	NA	1.0E+00	9.0E-01	2.9E-01	NA	5.0E-01	5.0E-02	NA	NA	5.0E-03
21	Chlorobenzene	2.0E-01	2.0E-02	NA	1.0E+00	5.0E-02	5.0E-03	NA	2.0E-01	2.0E-02	NA	NA	4.1E-02
22	Chloroform	1.0E-02	1.0E-02	6.1E-03	1.0E+00	NA	NA	8.1E-02	1.0E-02	1.0E-02	6.1E-03	NA	1.3E-01
23	Dichloroethane, 1,1-	1.0E+00	1.0E-01	NA	1.0E+00	1.4E+00	1.4E-01	NA	1.0E+00	1.0E-01	NA	NA	9.2E-03
24	Dichloroethene, 1,2- (total	9.0E-03	9.0E-03	NA	1.0E+00	NA	NA	NA	9.0E-03	9.0E-03	NA	NA	1.0E-02
25	Ethylbenzene	1.0E+00	1.0E-01	NA	8.2E-01	2.9E-01	2.9E-01	NA	8.2E-01	8.2E-02	NA	NA	1.0E+00
26	Methyl-2-pentanone, 4-	5.0E-01	5.0E-02	NA	1.0E+00	2.3E-01	2.3E-02	NA	5.0E-01	5.0E-02	NA	NA	3.3E-03
27	Methylene chloride	6.0E-02	6.0E-02	7.5E-03	1.0E+00	8.6E-01	8.6E-01	1.6E-03	6.0E-02	6.0E-02	7.5E-03	NA	4.8E-03
28	Tetrachloroethane, 1,1,2,2-	NA	NA	2.0E-01	1.0E+00	NA	NA	2.0E-01	NA	NA	2.0E-01	NA	9.0E-03
29	Tetrachloroethene	1.0E-01	1.0E-02	5.2E-02	1.0E+00	NA	NA	2.0E-03	1.0E-01	1.0E-02	5.2E-02	NA	3.7E-01
30	Toluene	2.0E+00	2.0E-01	NA	1E+00	5.7E-01	1.1E-01	NA	2.0E+00	2.0E-01	NA	NA	1.0E+00
31	Trichloroethane, 1,1,1-	9.0E-01	9.0E-02	NA	1.0E+00	2.9E+00	2.9E-01	NA	9.0E-01	9.0E-02	NA	NA	1.7E-02
32	Trichloroethane, 1,1,2-	4.0E-02	4.0E-03	5.7E-02	1.0E+00	NA	NA	5.7E-02	4.0E-02	4.0E-03	5.7E-02	NA	8.4E-03
33	Trichloroethene (c)	NA	6.0E-03	1.1E-02	1.0E+00	NA	NA	6.0E-03	NA	6.0E-03	1.1E-02	NA	2.3E-01
34	Vinyl acetate	1.0E+00	2.0E-01	NA	1.0E+00	5.7E-02	5.7E-02	NA	1.0E+00	2.0E-01	NA	NA	6.6E-03
35	Vinyl chloride	NA	NA	1.9E+00	9.0E-01	NA	NA	3.0E-01	NA	NA	2.1E+00	NA	7.3E-03
36	Xylenes (total)	4.0E+00	2.0E+00	NA	1E+00	NA	NA	NA	4.0E+00	2.0E+00	NA	NA	8.9E-02
37	Bis(2-ethylhexyl)phthalate	2.0E-02	2.0E-02	1.4E-02	1E+00	NA	NA	NA	2.0E-02	2.0E-02	1.4E-02	NA	7.5E-03
38	Di-n-butylphthalate	1.0E+00	1.0E-01	NA	8.5E-01	NA	NA	NA	8.5E-01	8.5E-02	NA	NA	3.6E-01

RANGE NAME: Er...

EXPOSURE POINT CONCENTRATIONS

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 1 (RME)
FILE NAME: DATA
LAST UPDATED: 10/27/92

EXPOSURE POINT: On-site

		MEDIUM 1 Groundwater			MEDIUM 2 Yard Soil			MEDIUM 3 Indoor Air Adjustment factor = 0.5			MEDIUM 4 Ambient Air			MEDIUM 5 Garden Veg.		
		Cs	Cc	Cl	Cs	Cc	Cl	Cs	Cc	Cl	Cs	Cc	Cl	Cs	Cc	Cl
	CHEMICAL NAME	11S	11C	11L	12S	12C	12L	13S	13C	13L	14S	14C	14L	15S	15C	15L
1	Aluminum	2.2E-01	2.2E-01	2.2E-01	1.2E+04	1.2E+04	1.2E+04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.1E-01	9.1E-01	9.1E-01
2	Antimony	2.6E-02	2.6E-02	2.6E-02	6.6E+00	6.6E+00	6.6E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.4E-02	2.4E-02	2.4E-02
3	Arsenic	4.2E-03	4.2E-03	4.2E-03	2.3E+00	2.3E+00	2.3E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.7E-03	1.7E-03	1.7E-03
4	Barium	5.6E-02	5.6E-02	5.6E-02	1.4E+02	1.4E+02	1.4E+02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	3.2E-01	3.2E-01	3.2E-01
5	Beryllium	5.0E-04	5.0E-04	5.0E-04	8.6E-01	8.6E-01	8.6E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.6E-04	1.6E-04	1.6E-04
6	Cadmium (food)	0.0E+00	0.0E+00	0.0E+00	1.3E+00	1.3E+00	1.3E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	2.0E-02	2.0E-02	2.0E-02
7	Chromium	6.9E-03	6.9E-03	6.9E-03	2.2E+01	2.2E+01	2.2E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	8.5E-03	8.5E-03	8.5E-03
8	Cobalt	7.0E-03	7.0E-03	7.0E-03	8.6E+00	8.6E+00	8.6E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	5.8E-03	5.8E-03	5.8E-03
9	Copper (b)	5.3E-03	5.3E-03	5.3E-03	3.6E+01	3.6E+01	3.6E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	7.8E-01	7.8E-01	7.8E-01
10	Lead	1.6E-03	1.6E-03	1.6E-03	1.4E+01	1.4E+01	1.4E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-02	1.4E-02	1.4E-02
11	Mercury	3.6E-04	3.6E-04	3.6E-04	6.5E-02	6.5E-02	6.5E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-03	1.4E-03	1.4E-03
12	Nickel	6.2E-02	6.2E-02	6.2E-02	2.2E+01	2.2E+01	2.2E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-01	1.1E-01	1.1E-01
13	Silver	4.5E-03	4.5E-03	4.5E-03	1.1E+00	1.1E+00	1.1E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.1E-02	1.1E-02	1.1E-02
14	Vanadium	4.0E-03	4.0E-03	4.0E-03	3.6E+01	3.6E+01	3.6E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.5E-03	9.5E-03	9.5E-03
15	Cyanide	3.7E-02	3.7E-02	3.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
16	Ammonia-N	1.0E+00	1.0E+00	1.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
17	Nitrate+Nitrite	1.6E+01	1.6E+01	1.6E+01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
18	Acetone	5.5E-02	5.5E-02	5.5E-02	1.4E-02	1.4E-02	1.4E-02	2.8E-02	2.8E-02	2.8E-02	0.0E+00	0.0E+00	0.0E+00	8.0E-03	8.0E-03	8.0E-03
19	Bromodichloromethane	1.7E-02	1.7E-02	1.7E-02	0.0E+00	0.0E+00	0.0E+00	8.7E-03	8.7E-03	8.7E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
20	Butanone, 2-	3.5E-02	3.5E-02	3.5E-02	0.0E+00	0.0E+00	0.0E+00	1.8E-02	1.8E-02	1.8E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
21	Chlorobenzene	0.0E+00	0.0E+00	0.0E+00	4.8E-03	4.8E-03	4.8E-03	0.0E+00	0.0E+00	0.0E+00	2.5E-07	1.1E-07	1.1E-07	1.5E-04	1.5E-04	1.5E-04
22	Chloroform	1.7E-02	1.7E-02	1.7E-02	0.0E+00	0.0E+00	0.0E+00	8.7E-03	8.7E-03	8.7E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
23	Dichloroethane, 1,1-	1.7E-02	1.7E-02	1.7E-02	0.0E+00	0.0E+00	0.0E+00	8.7E-03	8.7E-03	8.7E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
24	Dichloroethene, 1,2- (t	7.9E-01	7.9E-01	7.9E-01	2.2E-02	2.2E-02	2.2E-02	4.0E-01	4.0E-01	4.0E-01	0.0E+00	0.0E+00	0.0E+00	1.1E-03	1.1E-03	1.1E-03
25	Ethylbenzene	0.0E+00	0.0E+00	0.0E+00	2.5E-03	2.5E-03	2.5E-03	0.0E+00	0.0E+00	0.0E+00	1.6E-07	7.1E-08	7.1E-08	7.8E-05	7.8E-05	7.8E-05
26	Methyl-2-pentanone, 4-	3.4E-02	3.4E-02	3.4E-02	5.0E-03	5.0E-03	5.0E-03	1.7E-02	1.7E-02	1.7E-02	5.6E-08	2.5E-08	2.5E-08	5.5E-04	5.5E-04	5.5E-04
27	Methylene chloride	0.0E+00	0.0E+00	0.0E+00	6.4E-03	6.4E-03	6.4E-03	0.0E+00	0.0E+00	0.0E+00	8.8E-07	3.9E-07	3.9E-07	8.7E-04	8.7E-04	8.7E-04
28	Tetrachloroethane, 1,1,	0.0E+00	0.0E+00	0.0E+00	2.8E-03	2.8E-03	2.8E-03	0.0E+00	0.0E+00	0.0E+00	6.0E-08	2.7E-08	2.7E-08	9.5E-05	9.5E-05	9.5E-05
29	Tetrachloroethene	0.0E+00	0.0E+00	0.0E+00	2.1E-02	2.1E-02	2.1E-02	0.0E+00	0.0E+00	0.0E+00	1.5E-06	6.6E-07	6.6E-07	6.9E-04	6.9E-04	6.9E-04
30	Toluene	1.7E-02	1.7E-02	1.7E-02	6.9E-03	6.9E-03	6.9E-03	8.7E-03	8.7E-03	8.7E-03	1.0E-06	4.5E-07	4.5E-07	2.2E-04	2.2E-04	2.2E-04
31	Trichloroethane, 1,1,1-	1.7E-02	1.7E-02	1.7E-02	4.6E-03	4.6E-03	4.6E-03	8.7E-03	8.7E-03	8.7E-03	5.5E-07	2.5E-07	2.5E-07	1.6E-04	1.6E-04	1.6E-04
32	Trichloroethane, 1,1,2-	0.0E+00	0.0E+00	0.0E+00	2.8E-03	2.8E-03	2.8E-03	0.0E+00	0.0E+00	0.0E+00	1.1E-07	4.9E-08	4.9E-08	1.2E-04	1.2E-04	1.2E-04
33	Trichloroethene (c)	3.5E+00	3.5E+00	3.5E+00	5.2E-01	5.2E-01	5.2E-01	1.8E+00	1.8E+00	1.8E+00	4.0E-05	1.8E-05	1.8E-05	1.8E-02	1.8E-02	1.8E-02
34	Vinyl acetate	3.4E-02	3.4E-02	3.4E-02	0.0E+00	0.0E+00	0.0E+00	1.7E-02	1.7E-02	1.7E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
35	Vinyl chloride	6.0E-02	6.0E-02	6.0E-02	0.0E+00	0.0E+00	0.0E+00	3.0E-02	3.0E-02	3.0E-02	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
36	Xylenes (total)	1.7E-02	1.7E-02	1.7E-02	2.0E-03	2.0E-03	2.0E-03	8.7E-03	8.7E-03	8.7E-03	1.3E-07	5.7E-08	5.7E-08	6.3E-05	6.3E-05	6.3E-05
37	Bis(2-ethylhexyl)phthal	0.0E+00	0.0E+00	0.0E+00	2.1E-01	2.1E-01	2.1E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	1.4E-02	1.4E-02	1.4E-02
38	Di-n-butylphthalate	5.0E-03	5.0E-03	5.0E-03	2.2E-01	2.2E-01	2.2E-01	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	9.0E-03	9.0E-03	9.0E-03

RANGE NAME: EPC4

EXPOSURE POINT CONCENTRATIONS

EXPOSURE POINT: Target Pond

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 1 (RME)
FILE NAME: DATA
LAST UPDATED: 10/27/92

		MEDIUM 1 Surface Water			MEDIUM 2 Sediment			MEDIUM 3 0			MEDIUM 4 0			MEDIUM 5 0		
		Ce	Cc	Cl	Ce	Cc	Cl	Ce	Cc	Cl	Ce	Cc	Cl	Ce	Cc	Cl
	CHEMICAL NAME	21E	21C	21L	22E	22C	22L	23E	23C	23L	24E	24C	24L	25E	25C	25L
1	Aluminum	2.3E+00	2.3E+00	2.3E+00	2.2E+04	2.2E+04	2.2E+04									
2	Antimony	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
3	Arsenic	0.0E+00	0.0E+00	0.0E+00	5.4E+00	5.4E+00	5.4E+00									
4	Barium	0.0E+00	0.0E+00	0.0E+00	2.3E+02	2.3E+02	2.3E+02									
5	Beryllium	0.0E+00	0.0E+00	0.0E+00	1.3E+00	1.3E+00	1.3E+00									
6	Cadmium (food)	0.0E+00	0.0E+00	0.0E+00	4.1E+00	4.1E+00	4.1E+00									
7	Chromium	1.1E-02	1.1E-02	1.1E-02	6.0E+02	6.0E+02	6.0E+02									
8	Cobalt	0.0E+00	0.0E+00	0.0E+00	8.9E+00	8.9E+00	8.9E+00									
9	Copper (b)	0.0E+00	0.0E+00	0.0E+00	3.6E+03	3.6E+03	3.6E+03									
10	Lead	4.3E-03	4.3E-03	4.3E-03	9.8E+01	9.8E+01	9.8E+01									
11	Mercury	0.0E+00	0.0E+00	0.0E+00	4.9E-01	4.9E-01	4.9E-01									
12	Nickel	2.5E-01	2.5E-01	2.5E-01	2.7E+01	2.7E+01	2.7E+01									
13	Silver	7.7E-03	7.7E-03	7.7E-03	2.1E+00	2.1E+00	2.1E+00									
14	Vanadium	0.0E+00	0.0E+00	0.0E+00	4.0E+01	4.0E+01	4.0E+01									
15	Cyanide	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
16	Ammonia-N	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
17	Nitrate+Nitrite	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
18	Acetone	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
19	Bromodichloromethane	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
20	Butanone, 2-	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
21	Chlorobenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
22	Chloroform	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
23	Dichloroethane, 1,1-	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
24	Dichloroethene, 1,2- (t	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
25	Ethylbenzene	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
26	Methyl-2-pentanone, 4-	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
27	Methylene chloride	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
28	Tetrachloroethane, 1,1,	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
29	Tetrachloroethene	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
30	Toluene	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
31	Trichloroethane, 1,1,1-	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
32	Trichloroethane, 1,1,2-	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
33	Trichloroethene (c)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
34	Vinyl acetate	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
35	Vinyl chloride	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
36	Xylenes (total)	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
37	Bis(2-ethylhexyl)phthal	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									
38	Di-n-butylphthalate	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00									

RANGE NAME: EPC3

EXPOSURE POINT CONCENTRATIONS

EXPOSURE POINT: On-site (Worker)

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 1 (RME)
FILE NAME: DATA
LAST UPDATED: 10/27/92

		MEDIUM 1 Soil			MEDIUM 2 0			MEDIUM 3 0			MEDIUM 4 0			MEDIUM 5 0		
		Ce	Cc	Cl	Ce	Cc	Cl	Ce	Cc	Cl	Ce	Cc	Cl	Ce	Cc	Cl
	CHEMICAL NAME	31S	31C	31L	32S	32C	32L	33S	33C	33L	34S	34C	34L	35S	35C	35L
1	Aluminum	1.3E+04	1.3E+04	1.3E+04												
2	Antimony	1.7E+01	1.7E+01	1.7E+01												
3	Arsenic	1.3E+01	1.3E+01	1.3E+01												
4	Barium	1.2E+02	1.2E+02	1.2E+02												
5	Beryllium	1.2E+00	1.2E+00	1.2E+00												
6	Cadmium (food)	9.1E+00	9.1E+00	9.1E+00												
7	Chromium	2.3E+02	2.3E+02	2.3E+02												
8	Cobalt	1.5E+01	1.5E+01	1.5E+01												
9	Copper (b)	5.1E+02	5.1E+02	5.1E+02												
10	Lead	5.3E+01	5.3E+01	5.3E+01												
11	Mercury	3.7E-01	3.7E-01	3.7E-01												
12	Nickel	1.7E+01	1.7E+01	1.7E+01												
13	Silver	1.7E+00	1.7E+00	1.7E+00												
14	Vanadium	4.8E+01	4.8E+01	4.8E+01												
15	Cyanide	0.0E+00	0.0E+00	0.0E+00												
16	Ammonia-N	0.0E+00	0.0E+00	0.0E+00												
17	Nitrate+Nitrite	0.0E+00	0.0E+00	0.0E+00												
18	Acetone	0.0E+00	0.0E+00	0.0E+00												
19	Bromodichloromethane	0.0E+00	0.0E+00	0.0E+00												
20	Butanone, 2-	0.0E+00	0.0E+00	0.0E+00												
21	Chlorobenzene	0.0E+00	0.0E+00	0.0E+00												
22	Chloroform	0.0E+00	0.0E+00	0.0E+00												
23	Dichloroethane, 1,1-	0.0E+00	0.0E+00	0.0E+00												
24	Dichloroethene, 1,2- (t	0.0E+00	0.0E+00	0.0E+00												
25	Ethylbenzene	0.0E+00	0.0E+00	0.0E+00												
26	Methyl-2-pentanone, 4-	0.0E+00	0.0E+00	0.0E+00												
27	Methylene chloride	0.0E+00	0.0E+00	0.0E+00												
28	Tetrachloroethane, 1,1,	0.0E+00	0.0E+00	0.0E+00												
29	Tetrachloroethene	0.0E+00	0.0E+00	0.0E+00												
30	Toluene	0.0E+00	0.0E+00	0.0E+00												
31	Trichloroethane, 1,1,1-	0.0E+00	0.0E+00	0.0E+00												
32	Trichloroethane, 1,1,2-	0.0E+00	0.0E+00	0.0E+00												
33	Trichloroethene (c)	0.0E+00	0.0E+00	0.0E+00												
34	Vinyl acetate	0.0E+00	0.0E+00	0.0E+00												
35	Vinyl chloride	0.0E+00	0.0E+00	0.0E+00												
36	Xylenes (total)	0.0E+00	0.0E+00	0.0E+00												
37	Bis(2-ethylhexyl)phthal	0.0E+00	0.0E+00	0.0E+00												
38	Di-n-butylphthalate	0.0E+00	0.0E+00	0.0E+00												

RANGE NAME: POPSUM

EXPOSURE SCENARIOS EVALUATED
(GROUPED BY POPULATION)

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 1 (RME)
FILE NAME: DATA
LAST UPDATED: 10/27/92

POPULATION 1 — NO. OF SCENARIOS = 6

	LAND USE	EXPOSED POPULATION	EXPOSURE POINT	EXPOSURE MEDIUM	EXPOSURE ROUTE	HUMAN INTAKE FACTORS HIFs	HIFC	HIF1	WORKSHEET NAME
1	Future	Resident Adult	On-site	Groundwater	Oral		2.7E-02	1.2E-02	WS1
2			On-site	Groundwater	Dermal		5.5E-02	2.3E-02	WS2
3			On-site	Yard Soil	Oral		3.7E-06	1.6E-06	WS3
4			On-site	Indoor Air	Inhalation		2.1E-01	8.8E-02	WS4
5			On-site	Ambient Air	Inhalation		2.7E-01	1.2E-01	WS5
6			On-site	Garden Veg.	Oral		1.1E-03	4.7E-04	WS6

POPULATION 2 — NO. OF SCENARIOS = 6

	LAND USE	EXPOSED POPULATION	EXPOSURE POINT	EXPOSURE MEDIUM	EXPOSURE ROUTE	HUMAN INTAKE FACTORS HIFs	HIFC	HIF1	RANGE NAME
1	Future	Resident Child	On-site	Groundwater	Oral	6.4E-02		5.5E-03	WS1
2			On-site	Groundwater	Dermal	9.2E-02		7.9E-03	WS2
3			On-site	Yard Soil	Oral	1.3E-05		1.1E-06	WS3
4			On-site	Indoor Air	Inhalation	1.2E+00		9.9E-02	WS4
5			On-site	Ambient Air	Inhalation	1.5E+00		1.3E-01	WS5
6			On-site	Garden Veg.	Oral	2.6E-03		2.2E-04	WS6

POPULATION 3 — NO. OF SCENARIOS = 3

	LAND USE	EXPOSED POPULATION	EXPOSURE POINT	EXPOSURE MEDIUM	EXPOSURE ROUTE	HUMAN INTAKE FACTORS HIFs	HIFC	HIF1	RANGE NAME
1	Future	Resident Youngster	Target Pond	Surface Water	Oral		1.2E-04	1.0E-05	WS1
2			Target Pond	Surface Water	Dermal		3.2E-02	4.6E-03	WS2
3			Target Pond	Sediment	Oral		2.5E-07	3.5E-08	WS3
4									WS4
5									WS5
6									WS6

POPULATION 4 — NO. OF SCENARIOS = 1

	LAND USE	EXPOSED POPULATION	EXPOSURE POINT	EXPOSURE MEDIUM	EXPOSURE ROUTE	HUMAN INTAKE FACTORS HIFs	HIFC	HIF1	RANGE NAME
1	Current	Worker	On-site (Worker)	Soil	Oral		2.4E-07	8.7E-08	WS1
2									WS2
3									WS3
4									WS4
5									WS5
6									WS6

RANGE NAME: WS1

EXPOSURE AND RISK CALCULATION WORKSHEET

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP2
LAST UPDATED: 10/26/92

LAND USE: Future
POPULATION: Resident Child

EXPOSURE POINT: On-site
MEDIUM: Groundwater
ROUTE: Oral

HIFs = 3.0E-02
HIFc = 0.0E+00
HIFl = 3.3E-03

	CHEMICAL NAME	SUBCHRONIC Cs	HIFs	l	DIs	RfDS	HQs	CHRONIC Cc	HIFc	l	DIc	RfDC	HQc	LIFETIME Cl	HIFl	l	DIl	SF	RISK
1	Aluminum	2.2E-01	3.0E-02	1	6.3E-03		NA		0.0E+00		0.0E+00		ERR	2.2E-01	3.3E-03	1	7.2E-04		NA
2	Antimony	2.6E-02	3.0E-02	1	9.7E-04	4.0E-04	2E+00							2.6E-02	3.3E-03	1	8.4E-05		NA
3	Arsenic	4.2E-03	3.0E-02	1	1.6E-04	3.0E-04	5E-01							4.2E-03	3.3E-03	1	1.4E-05	1.8E+00	2E-05
4	Barium	5.6E-02	3.0E-02	1	2.1E-03	7.0E-02	3E-02							5.6E-02	3.3E-03	1	1.9E-04		NA
5	Beryllium	5.0E-04	3.0E-02	1	1.9E-05	5.0E-03	4E-03							5.0E-04	3.3E-03	1	1.7E-06	4.3E+00	7E-06
6	Cadmium (food)	0.0E+00	3.0E-02	1	0.0E+00		NA							0.0E+00	3.3E-03	1	0.0E+00		NA
7	Chromium	6.9E-03	3.0E-02	1	2.6E-04	2.0E-02	1E-02							6.9E-03	3.3E-03	1	2.3E-05		NA
8	Cobalt	7.0E-03	3.0E-02	1	2.7E-04		NA							7.0E-03	3.3E-03	1	2.3E-05		NA
9	Copper (b)	5.3E-03	3.0E-02	1	2.0E-04	3.7E-02	5E-03							5.3E-03	3.3E-03	1	1.8E-05		NA
10	Lead	1.6E-03	3.0E-02	1	6.1E-05		NA							1.6E-03	3.3E-03	1	5.3E-06		NA
11	Mercury	3.6E-04	3.0E-02	1	1.4E-05	3.0E-04	5E-02							3.6E-04	3.3E-03	1	1.2E-06		NA
12	Nickel	6.2E-02	3.0E-02	1	2.3E-03	2.0E-02	1E-01							6.2E-02	3.3E-03	1	2.0E-04		NA
13	Silver	4.5E-03	3.0E-02	1	1.7E-04	5.0E-03	3E-02							4.5E-03	3.3E-03	1	1.5E-05		NA
14	Vanadium	4.0E-03	3.0E-02	1	1.5E-04	7.0E-03	2E-02							4.0E-03	3.3E-03	1	1.3E-05		NA
15	Cyanide	3.7E-02	3.0E-02	1	1.4E-03	2.0E-02	7E-02							3.7E-02	3.3E-03	1	1.2E-04		NA
16	Ammonia-N	1.0E+00	3.0E-02	1	3.8E-02	9.7E-01	4E-02							1.0E+00	3.3E-03	1	3.3E-03		NA
17	Nitrate+Nitrit	1.6E+01	3.0E-02	1	6.1E-01	1.0E-01	6E+00							1.6E+01	3.3E-03	1	5.3E-02		NA
18	Acetone	5.5E-02	3.0E-02	1	2.1E-03	1.0E+00	2E-03							5.5E-02	3.3E-03	1	1.8E-04		NA
19	Bromodichlorom	1.7E-02	3.0E-02	1	6.6E-04	2.0E-02	3E-02							1.7E-02	3.3E-03	1	5.7E-05	1.3E-01	7E-06
20	Butanone, 2-	3.5E-02	3.0E-02	1	1.3E-03	5.0E-01	3E-03							3.5E-02	3.3E-03	1	1.2E-04		NA
21	Chlorobenzene	0.0E+00	3.0E-02	1	0.0E+00	2.0E-01	0E+00							0.0E+00	3.3E-03	1	0.0E+00		NA
22	Chloroform	1.7E-02	3.0E-02	1	6.6E-04	1.0E-02	7E-02							1.7E-02	3.3E-03	1	5.7E-05	6.1E-03	3E-07
23	Dichloroethane	1.7E-02	3.0E-02	1	6.6E-04	1.0E+00	7E-04							1.7E-02	3.3E-03	1	5.7E-05		NA
24	Dichloroethene	7.9E-01	3.0E-02	1	3.0E-02	9.0E-03	3E+00							7.9E-01	3.3E-03	1	2.6E-03		NA
25	Ethylbenzene	0.0E+00	3.0E-02	1	0.0E+00	1.0E+00	0E+00							0.0E+00	3.3E-03	1	0.0E+00		NA
26	Methyl-2-penta	3.4E-02	3.0E-02	1	1.3E-03	5.0E-01	3E-03							3.4E-02	3.3E-03	1	1.1E-04		NA
27	Methylene chlo	0.0E+00	3.0E-02	1	0.0E+00	6.0E-02	0E+00							0.0E+00	3.3E-03	1	0.0E+00	7.5E-03	0E+00
28	Tetrachloroeth	0.0E+00	3.0E-02	1	0.0E+00		NA							0.0E+00	3.3E-03	1	0.0E+00	2.0E-01	0E+00
29	Tetrachloroeth	0.0E+00	3.0E-02	1	0.0E+00	1.0E-01	0E+00							0.0E+00	3.3E-03	1	0.0E+00	5.2E-02	0E+00
30	Toluene	1.7E-02	3.0E-02	1	6.6E-04	2.0E+00	3E-04							1.7E-02	3.3E-03	1	5.7E-05		NA
31	Trichloroethan	1.7E-02	3.0E-02	1	6.6E-04	9.0E-01	7E-04							1.7E-02	3.3E-03	1	5.7E-05		NA
32	Trichloroethan	0.0E+00	3.0E-02	1	0.0E+00	4.0E-02	0E+00							0.0E+00	3.3E-03	1	0.0E+00	5.7E-02	0E+00
33	Trichloroethen	3.5E+00	3.0E-02	1	1.3E-01		NA							3.5E+00	3.3E-03	1	1.2E-02	1.1E-02	1E-04
34	Vinyl acetate	3.4E-02	3.0E-02	1	1.3E-03	1.0E+00	1E-03							3.4E-02	3.3E-03	1	1.1E-04		NA
35	Vinyl chloride	6.0E-02	3.0E-02	1	2.3E-03		NA							6.0E-02	3.3E-03	1	2.0E-04	1.9E+00	4E-04
36	Xylenes (total	1.7E-02	3.0E-02	1	6.6E-04	4.0E+00	2E-04							1.7E-02	3.3E-03	1	5.7E-05		NA
37	Bis(2-ethylhex	0.0E+00	3.0E-02	1	0.0E+00	2.0E-02	0E+00							0.0E+00	3.3E-03	1	0.0E+00	1.4E-02	0E+00
38	Di-n-butylphth	5.0E-03	3.0E-02	1	1.9E-04	1.0E+00	2E-04							5.0E-03	3.3E-03	1	1.7E-05		NA

RANGE NAME: WS2

EXPOSURE AND RISK CALCULATION WORKSHEET

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP2
LAST UPDATED: 10/26/92

LAND USE: Future
POPULATION: Resident Child

EXPOSURE POINT: On-site
MEDIUM: Groundwater
ROUTE: Dermal

HIFs = 7.7E-02
HIFc = 8.0E+00
HIFl = 6.6E-03

		SUBCHRONIC						CHRONIC						LIFETIME					
	CHEMICAL NAME	Cs	HIFs	P	DIs	RfDS	HQs	Cc	HIFc	P	DIc	RfDC	HQc	Cl	HIFl	P	DIl	SF	RISK
1	Aluminum	2.2E-01	7.7E-02	1.0E-03	1.7E-05	NA	NA		0.0E+00		0.0E+00		ERR	2.2E-01	6.6E-03	1.0E-03	1.4E-06	NA	NA
2	Antimony	2.6E-02	7.7E-02	1.0E-03	2.0E-06	4.0E-05	5E-02							2.6E-02	6.6E-03	1.0E-03	1.7E-07	NA	NA
3	Arsenic	4.2E-03	7.7E-02	1.0E-03	3.2E-07	2.9E-04	1E-03							4.2E-03	6.6E-03	1.0E-03	2.8E-08	1.8E+00	5E-08
4	Barium	5.6E-02	7.7E-02	1.0E-03	4.3E-06	7.0E-03	6E-04							5.6E-02	6.6E-03	1.0E-03	3.7E-07	NA	NA
5	Beryllium	5.0E-04	7.7E-02	1.0E-03	3.9E-08	2.5E-05	2E-03							5.0E-04	6.6E-03	1.0E-03	3.3E-09	8.6E+02	3E-06
6	Cadmium (food)	0.0E+00	7.7E-02	NA	NA	NA	NA							0.0E+00	6.6E-03	NA	NA	NA	NA
7	Chromium	6.9E-03	7.7E-02	1.0E-03	5.3E-07	1.0E-03	5E-04							6.9E-03	6.6E-03	1.0E-03	4.6E-08	NA	NA
8	Cobalt	7.0E-03	7.7E-02	1.0E-03	5.4E-07	NA	NA							7.0E-03	6.6E-03	1.0E-03	4.6E-08	NA	NA
9	Copper (b)	5.3E-03	7.7E-02	1.0E-03	4.1E-07	1.9E-02	2E-05							5.3E-03	6.6E-03	1.0E-03	3.5E-08	NA	NA
10	Lead	1.6E-03	7.7E-02	1.0E-03	1.2E-07	NA	NA							1.6E-03	6.6E-03	1.0E-03	1.1E-08	NA	NA
11	Mercury	3.6E-04	7.7E-02	1.0E-03	2.8E-08	6.0E-06	5E-03							3.6E-04	6.6E-03	1.0E-03	2.4E-09	NA	NA
12	Nickel	6.2E-02	7.7E-02	1.0E-03	4.7E-06	1.0E-03	5E-03							6.2E-02	6.6E-03	1.0E-03	4.1E-07	NA	NA
13	Silver	4.5E-03	7.7E-02	1.0E-03	3.5E-07	2.5E-04	1E-03							4.5E-03	6.6E-03	1.0E-03	3.0E-08	NA	NA
14	Vanadium	4.0E-03	7.7E-02	1.0E-03	3.1E-07	7.0E-05	4E-03							4.0E-03	6.6E-03	1.0E-03	2.6E-08	NA	NA
15	Cyanide	3.7E-02	7.7E-02	1.0E-03	2.8E-06	2.0E-02	1E-04							3.7E-02	6.6E-03	1.0E-03	2.4E-07	NA	NA
16	Ammonia-N	1.0E+00	7.7E-02	1.0E-03	7.7E-05	9.7E-01	8E-05							1.0E+00	6.6E-03	1.0E-03	6.6E-06	NA	NA
17	Nitrate+Nitrit	1.6E+01	7.7E-02	1.0E-03	1.2E-03	1.0E-01	1E-02							1.6E+01	6.6E-03	1.0E-03	1.1E-04	NA	NA
18	Acetone	5.5E-02	7.7E-02	5.7E-04	2.4E-06	1.0E+00	2E-06							5.5E-02	6.6E-03	5.7E-04	2.1E-07	NA	NA
19	Bromodichlorom	1.7E-02	7.7E-02	5.0E-03	7.7E-06	2.0E-02	4E-04							1.7E-02	6.6E-03	5.0E-03	6.6E-07	1.3E-01	9E-08
20	Butanone, 2-	3.5E-02	7.7E-02	5.0E-03	1.4E-05	5.0E-01	3E-05							3.5E-02	6.6E-03	5.0E-03	1.2E-06	NA	NA
21	Chlorobenzene	0.0E+00	7.7E-02	4.1E-02	0.0E+00	2.0E-01	0E+00							0.0E+00	6.6E-03	4.1E-02	0.0E+00	NA	NA
22	Chloroform	1.7E-02	7.7E-02	1.3E-01	1.7E-04	1.0E-02	2E-02							1.7E-02	6.6E-03	1.3E-01	1.5E-05	6.1E-03	9E-08
23	Dichloroethane	1.7E-02	7.7E-02	9.2E-03	1.2E-05	1.0E+00	1E-05							1.7E-02	6.6E-03	9.2E-03	1.1E-06	NA	NA
24	Dichloroethene	7.9E-01	7.7E-02	1.0E-02	6.1E-04	9.0E-03	7E-02							7.9E-01	6.6E-03	1.0E-02	5.2E-05	NA	NA
25	Ethylbenzene	0.0E+00	7.7E-02	1.0E+00	0.0E+00	8.2E-01	0E+00							0.0E+00	6.6E-03	1.0E+00	0.0E+00	NA	NA
26	Methyl-2-penta	3.4E-02	7.7E-02	3.3E-03	8.6E-06	5.0E-01	2E-05							3.4E-02	6.6E-03	3.3E-03	7.4E-07	NA	NA
27	Methylene chlo	0.0E+00	7.7E-02	4.8E-03	0.0E+00	6.0E-02	0E+00							0.0E+00	6.6E-03	4.8E-03	0.0E+00	7.5E-03	0E+00
28	Tetrachloroeth	0.0E+00	7.7E-02	9.0E-03	0.0E+00	NA	NA							0.0E+00	6.6E-03	9.0E-03	0.0E+00	2.0E-01	0E+00
29	Tetrachloroeth	0.0E+00	7.7E-02	3.7E-01	0.0E+00	1.0E-01	0E+00							0.0E+00	6.6E-03	3.7E-01	0.0E+00	5.2E-02	0E+00
30	Toluene	1.7E-02	7.7E-02	1.0E+00	1.3E-03	2.0E+00	7E-04							1.7E-02	6.6E-03	1.0E+00	1.1E-04	NA	NA
31	Trichloroethan	1.7E-02	7.7E-02	1.7E-02	2.3E-05	9.0E-01	3E-05							1.7E-02	6.6E-03	1.7E-02	1.9E-06	NA	NA
32	Trichloroethan	0.0E+00	7.7E-02	8.4E-03	0.0E+00	4.0E-02	0E+00							0.0E+00	6.6E-03	8.4E-03	0.0E+00	5.7E-02	0E+00
33	Trichloroethen	3.5E+00	7.7E-02	2.3E-01	6.2E-02	NA	NA							3.5E+00	6.6E-03	2.3E-01	5.3E-03	1.1E-02	6E-05
34	Vinyl acetate	3.4E-02	7.7E-02	6.6E-03	1.7E-05	1.0E+00	2E-05							3.4E-02	6.6E-03	6.6E-03	1.5E-06	NA	NA
35	Vinyl chloride	6.0E-02	7.7E-02	7.3E-03	3.4E-05	NA	NA							6.0E-02	6.6E-03	7.3E-03	2.9E-06	2.1E+00	6E-06
36	Xylenes (total	1.7E-02	7.7E-02	8.9E-02	1.2E-04	4.0E+00	3E-05							1.7E-02	6.6E-03	8.9E-02	1.0E-05	NA	NA
37	Bis(2-ethylhex	0.0E+00	7.7E-02	7.5E-03	0.0E+00	2.0E-02	0E+00							0.0E+00	6.6E-03	7.5E-03	0.0E+00	1.4E-02	0E+00
38	Di-n-butylphth	5.0E-03	7.7E-02	3.6E-01	1.4E-04	8.5E-01	2E-04							5.0E-03	6.6E-03	3.6E-01	1.2E-05	NA	NA

RANGE NAME: WS3

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP2
LAST UPDATED: 10/26/92

EXPOSURE AND RISK CALCULATION WORKSHEET

LAND USE: Future
POPULATION: Resident Child

EXPOSURE POINT: On-site
MEDIUM: Yard Soil
ROUTE: Oral

SFo = 6.4E-06
SFo = 0.0E+00
SFl = 5.5E-07

		SUBCHRONIC						CHRONIC						LIFETIME					
	CHEMICAL NAME	Cs	SFs	l	DIs	RfDS	HQs	Cc	SFc	l	DIc	RfDC	HQc	Cl	SFl	l	DIl	SF	RISK
1	Aluminum	1.2E+04	6.4E-06	1	7.5E-02	NA	NA		0.0E+00		0.0E+00		ERR	1.2E+04	5.5E-07	1	6.4E-03	NA	NA
2	Antimony	6.6E+00	6.4E-06	1	4.2E-05	4.0E-04	1E-01							6.6E+00	5.5E-07	1	3.6E-06	NA	NA
3	Arsenic	2.3E+00	6.4E-06	1	1.5E-05	3.0E-04	5E-02							2.3E+00	5.5E-07	1	1.3E-06	1.8E+00	2E-06
4	Barium	1.4E+02	6.4E-06	1	9.2E-04	7.0E-02	1E-02							1.4E+02	5.5E-07	1	7.9E-05	NA	NA
5	Beryllium	8.6E-01	6.4E-06	1	5.5E-06	5.0E-03	1E-03							8.6E-01	5.5E-07	1	4.7E-07	4.3E+00	2E-06
6	Cadmium (food)	1.3E+00	6.4E-06	1	8.3E-06	NA	NA							1.3E+00	5.5E-07	1	7.2E-07	NA	NA
7	Chromium	2.2E+01	6.4E-06	1	1.4E-04	2.0E-02	7E-03							2.2E+01	5.5E-07	1	1.2E-05	NA	NA
8	Cobalt	8.6E+00	6.4E-06	1	5.5E-05	NA	NA							8.6E+00	5.5E-07	1	4.7E-06	NA	NA
9	Copper (b)	3.6E+01	6.4E-06	1	2.3E-04	3.7E-02	6E-03							3.6E+01	5.5E-07	1	2.0E-05	NA	NA
10	Lead	1.4E+01	6.4E-06	1	9.1E-05	NA	NA							1.4E+01	5.5E-07	1	7.8E-06	NA	NA
11	Mercury	6.5E-02	6.4E-06	1	4.2E-07	3.0E-04	1E-03							6.5E-02	5.5E-07	1	3.6E-08	NA	NA
12	Nickel	2.2E+01	6.4E-06	1	1.4E-04	2.0E-02	7E-03							2.2E+01	5.5E-07	1	1.2E-05	NA	NA
13	Silver	1.1E+00	6.4E-06	1	6.8E-06	5.0E-03	1E-03							1.1E+00	5.5E-07	1	5.9E-07	NA	NA
14	Vanadium	3.6E+01	6.4E-06	1	2.3E-04	7.0E-03	3E-02							3.6E+01	5.5E-07	1	2.0E-05	NA	NA
15	Cyanide	0.0E+00	6.4E-06	1	0.0E+00	2.0E-02	0E+00							0.0E+00	5.5E-07	1	0.0E+00	NA	NA
16	Ammonia-N	0.0E+00	6.4E-06	1	0.0E+00	9.7E-01	0E+00							0.0E+00	5.5E-07	1	0.0E+00	NA	NA
17	Nitrate+Nitrit	0.0E+00	6.4E-06	1	0.0E+00	1.0E-01	0E+00							0.0E+00	5.5E-07	1	0.0E+00	NA	NA
18	Acetone	1.4E-02	6.4E-06	1	9.0E-08	1.0E+00	9E-08							1.4E-02	5.5E-07	1	7.7E-09	NA	NA
19	Bromodichlorom	0.0E+00	6.4E-06	1	0.0E+00	2.0E-02	0E+00							0.0E+00	5.5E-07	1	0.0E+00	1.3E-01	0E+00
20	Butanone, 2-	0.0E+00	6.4E-06	1	0.0E+00	5.0E-01	0E+00							0.0E+00	5.5E-07	1	0.0E+00	NA	NA
21	Chlorobenzene	4.8E-03	6.4E-06	1	3.1E-08	2.0E-01	2E-07							4.8E-03	5.5E-07	1	2.7E-09	NA	NA
22	Chloroform	0.0E+00	6.4E-06	1	0.0E+00	1.0E-02	0E+00							0.0E+00	5.5E-07	1	0.0E+00	6.1E-03	0E+00
23	Dichloroethane	0.0E+00	6.4E-06	1	0.0E+00	1.0E+00	0E+00							0.0E+00	5.5E-07	1	0.0E+00	NA	NA
24	Dichloroethene	2.2E-02	6.4E-06	1	1.4E-07	9.0E-03	2E-05							2.2E-02	5.5E-07	1	1.2E-08	NA	NA
25	Ethylbenzene	2.5E-03	6.4E-06	1	1.6E-08	1.0E+00	2E-08							2.5E-03	5.5E-07	1	1.4E-09	NA	NA
26	Methyl-2-penta	5.0E-03	6.4E-06	1	3.2E-08	5.0E-01	6E-08							5.0E-03	5.5E-07	1	2.8E-09	NA	NA
27	Methylene chlo	6.4E-03	6.4E-06	1	4.1E-08	6.0E-02	7E-07							6.4E-03	5.5E-07	1	3.5E-09	7.5E-03	3E-11
28	Tetrachloroeth	2.8E-03	6.4E-06	1	1.8E-08	NA	NA							2.8E-03	5.5E-07	1	1.5E-09	2.0E-01	3E-10
29	Tetrachloroeth	2.1E-02	6.4E-06	1	1.4E-07	1.0E-01	1E-06							2.1E-02	5.5E-07	1	1.2E-08	5.2E-02	6E-10
30	Toluene	6.9E-03	6.4E-06	1	4.4E-08	2.0E+00	2E-08							6.9E-03	5.5E-07	1	3.8E-09	NA	NA
31	Trichloroethan	4.6E-03	6.4E-06	1	3.0E-08	9.0E-01	3E-08							4.6E-03	5.5E-07	1	2.6E-09	NA	NA
32	Trichloroethan	2.8E-03	6.4E-06	1	1.8E-08	4.0E-02	4E-07							2.8E-03	5.5E-07	1	1.5E-09	5.7E-02	9E-11
33	Trichloroethen	5.2E-01	6.4E-06	1	3.3E-06	NA	NA							5.2E-01	5.5E-07	1	2.9E-07	1.1E-02	3E-09
34	Vinyl acetate	0.0E+00	6.4E-06	1	0.0E+00	1.0E+00	0E+00							0.0E+00	5.5E-07	1	0.0E+00	NA	NA
35	Vinyl chloride	0.0E+00	6.4E-06	1	0.0E+00	NA	NA							0.0E+00	5.5E-07	1	0.0E+00	1.9E+00	0E+00
36	Xylenes (total	2.0E-03	6.4E-06	1	1.3E-08	4.0E+00	3E-09							2.0E-03	5.5E-07	1	1.1E-09	NA	NA
37	Bis(2-ethylhex	2.1E-01	6.4E-06	1	1.3E-06	2.0E-02	7E-05							2.1E-01	5.5E-07	1	1.2E-07	1.4E-02	2E-09
38	Di-n-butylphth	2.2E-01	6.4E-06	1	1.4E-06	1.0E+00	1E-06							2.2E-01	5.5E-07	1	1.2E-07	NA	NA

RANGE NAME: WS4

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP2
LAST UPDATED: 10/26/92

EXPOSURE AND RISK CALCULATION WORKSHEET

LAND USE: Future
POPULATION: Resident Child

EXPOSURE POINT: On-site
MEDIUM: Indoor Air
ROUTE: Inhalation

IFs = 1.0E+00
IFc = 0.0E+00
IFl = 0.0E-02

		SUBCHRONIC						CHRONIC						LIFETIME					
	CHEMICAL NAME	Cs	IFs	l	DIs	RfDS	HQs	Cc	IFc	l	DIc	RfDC	HQc	Cl	IFl	l	DIl	SF	RISK
1	Aluminum	0.0E+00	1.0E+00	1	0.0E+00	NA	NA		0.0E+00		0.0E+00		ERR	0.0E+00	0.0E-02	1	0.0E+00	NA	NA
2	Antimony	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
3	Arsenic	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	1.5E+01	0E+00
4	Barium	0.0E+00	1.0E+00	1	0.0E+00	1.4E-03	0E+00							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
5	Beryllium	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	8.4E+00	0E+00
6	Cadmium (food)	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	6.3E+00	0E+00
7	Chromium	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	4.2E+01	0E+00
8	Cobalt	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
9	Copper (b)	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
10	Lead	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
11	Mercury	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
12	Nickel	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	8.4E-01	0E+00
13	Silver	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
14	Vanadium	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
15	Cyanide	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
16	Ammonia-N	0.0E+00	1.0E+00	1	0.0E+00	2.9E-02	0E+00							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
17	Nitrate+Nitrit	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
18	Acetone	2.8E-02	1.0E+00	1	2.8E-02	NA	NA							2.8E-02	0.0E-02	1	2.4E-03	NA	NA
19	Bromodichlorom	8.7E-03	1.0E+00	1	8.7E-03	NA	NA							8.7E-03	0.0E-02	1	7.6E-04	NA	NA
20	Butanone, 2-	1.8E-02	1.0E+00	1	1.8E-02	9.0E-01	2E-02							1.8E-02	0.0E-02	1	1.6E-03	NA	NA
21	Chlorobenzene	0.0E+00	1.0E+00	1	0.0E+00	5.0E-02	0E+00							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
22	Chloroform	8.7E-03	1.0E+00	1	8.7E-03	NA	NA							8.7E-03	0.0E-02	1	7.6E-04	8.1E-02	6E-05
23	Dichloroethane	8.7E-03	1.0E+00	1	8.7E-03	1.4E+00	6E-03							8.7E-03	0.0E-02	1	7.6E-04	NA	NA
24	Dichloroethene	4.0E-01	1.0E+00	1	4.0E-01	NA	NA							4.0E-01	0.0E-02	1	3.5E-02	NA	NA
25	Ethylbenzene	0.0E+00	1.0E+00	1	0.0E+00	2.9E-01	0E+00							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
26	Methyl-2-penta	1.7E-02	1.0E+00	1	1.7E-02	2.3E-01	7E-02							1.7E-02	0.0E-02	1	1.5E-03	NA	NA
27	Methylene chlo	0.0E+00	1.0E+00	1	0.0E+00	8.6E-01	0E+00							0.0E+00	0.0E-02	1	0.0E+00	1.6E-03	0E+00
28	Tetrachloroeth	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	2.0E-01	0E+00
29	Tetrachloroeth	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	2.0E-03	0E+00
30	Toluene	8.7E-03	1.0E+00	1	8.7E-03	5.7E-01	2E-02							8.7E-03	0.0E-02	1	7.6E-04	NA	NA
31	Trichloroethan	8.7E-03	1.0E+00	1	8.7E-03	2.9E+00	3E-03							8.7E-03	0.0E-02	1	7.6E-04	NA	NA
32	Trichloroethan	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	5.7E-02	0E+00
33	Trichloroethen	1.8E+00	1.0E+00	1	1.8E+00	NA	NA							1.8E+00	0.0E-02	1	1.5E-01	6.0E-03	9E-04
34	Vinyl acetate	1.7E-02	1.0E+00	1	1.7E-02	5.7E-02	3E-01							1.7E-02	0.0E-02	1	1.5E-03	NA	NA
35	Vinyl chloride	3.0E-02	1.0E+00	1	3.0E-02	NA	NA							3.0E-02	0.0E-02	1	2.7E-03	3.0E-01	8E-04
36	Xylenes (total	8.7E-03	1.0E+00	1	8.7E-03	NA	NA							8.7E-03	0.0E-02	1	7.6E-04	NA	NA
37	Bis(2-ethylhex	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA
38	Di-n-butylphth	0.0E+00	1.0E+00	1	0.0E+00	NA	NA							0.0E+00	0.0E-02	1	0.0E+00	NA	NA

RANGE NAME: WS_

EXPOSURE AND RISK CALCULATION WORKSHEET

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP2
LAST UPDATED: 10/26/92

LAND USE: Future
POPULATION: Resident Child

EXPOSURE POINT: On-site
MEDIUM: Ambient Air
ROUTE: Inhalation

HIFs = 1.3E+00
HIFc = 0.0E+00
HIFl = 1.1E-01

		SUBCHRONIC						CHRONIC						LIFETIME					
	CHEMICAL NAME	Cs	HIFs	1	DIs	RfDS	HQs	Cc	HIFc	1	DIc	RfDC	HQc	Cl	HIFl	1	DIl	SF	RISK
1	Aluminum	0.0E+00	1.3E+00	1	0.0E+00	NA	NA		0.0E+00		0.0E+00		ERR	0.0E+00	1.1E-01	1	0.0E+00	NA	NA
2	Antimony	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
3	Arsenic	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	1.5E+01	0E+00
4	Barium	0.0E+00	1.3E+00	1	0.0E+00	1.4E-03	0E+00							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
5	Beryllium	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	8.4E+00	0E+00
6	Cadmium (food)	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	6.3E+00	0E+00
7	Chromium	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	4.2E+01	0E+00
8	Cobalt	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
9	Copper (b)	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
10	Lead	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
11	Mercury	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
12	Nickel	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	8.4E-01	0E+00
13	Silver	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
14	Vanadium	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
15	Cyanide	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
16	Ammonia-N	0.0E+00	1.3E+00	1	0.0E+00	2.9E-02	0E+00							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
17	Nitrate+Nitrit	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
18	Acetone	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
19	Bromodichlorom	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
20	Butanone, 2-	0.0E+00	1.3E+00	1	0.0E+00	9.0E-01	0E+00							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
21	Chlorobenzene	2.5E-07	1.3E+00	1	3.3E-07	5.0E-02	7E-06							1.1E-07	1.1E-01	1	1.2E-08	NA	NA
22	Chloroform	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	8.1E-02	0E+00
23	Dichloroethane	0.0E+00	1.3E+00	1	0.0E+00	1.4E+00	0E+00							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
24	Dichloroethene	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
25	Ethylbenzene	1.6E-07	1.3E+00	1	2.1E-07	2.9E-01	7E-07							7.1E-08	1.1E-01	1	7.8E-09	NA	NA
26	Methyl-2-penta	5.6E-08	1.3E+00	1	7.3E-08	2.3E-01	3E-07							2.5E-08	1.1E-01	1	2.8E-09	NA	NA
27	Methylene chlo	8.8E-07	1.3E+00	1	1.1E-06	8.6E-01	1E-06							3.9E-07	1.1E-01	1	4.3E-08	1.6E-03	7E-11
28	Tetrachloroeth	6.0E-08	1.3E+00	1	7.8E-08	NA	NA							2.7E-08	1.1E-01	1	3.0E-09	2.0E-01	6E-10
29	Tetrachloroeth	1.5E-06	1.3E+00	1	2.0E-06	NA	NA							6.6E-07	1.1E-01	1	7.3E-08	2.0E-03	1E-10
30	Toluene	1.0E-06	1.3E+00	1	1.3E-06	5.7E-01	2E-06							4.5E-07	1.1E-01	1	5.0E-08	NA	NA
31	Trichloroethan	5.5E-07	1.3E+00	1	7.2E-07	2.9E+00	2E-07							2.5E-07	1.1E-01	1	2.8E-08	NA	NA
32	Trichloroethan	1.1E-07	1.3E+00	1	1.4E-07	NA	NA							4.9E-08	1.1E-01	1	5.4E-09	5.7E-02	3E-10
33	Trichloroethen	4.0E-05	1.3E+00	1	5.2E-05	NA	NA							1.8E-05	1.1E-01	1	2.0E-06	6.0E-03	1E-08
34	Vinyl acetate	0.0E+00	1.3E+00	1	0.0E+00	5.7E-02	0E+00							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
35	Vinyl chloride	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	3.0E-01	0E+00
36	Xylenes (total	1.3E-07	1.3E+00	1	1.7E-07	NA	NA							5.7E-08	1.1E-01	1	6.3E-09	NA	NA
37	Bis(2-ethylhex	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA
38	Di-n-butylphth	0.0E+00	1.3E+00	1	0.0E+00	NA	NA							0.0E+00	1.1E-01	1	0.0E+00	NA	NA

RANGE NAME: WSe

EXPOSURE AND RISK CALCULATION WORKSHEET

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP2
LAST UPDATED: 10/26/92

LAND USE: Future
POPULATION: Resident Child

EXPOSURE POINT: On-site
MEDIUM: Garden Veg.
ROUTE: Oral

HIFe = 1.6E-03
HIFc = 0.0E+00
HIFl = 1.4E-04

		SUBCHRONIC						CHRONIC						LIFETIME					
	CHEMICAL NAME	Ce	HIFe	l	DIe	RfDe	HQe	Cc	HIFc	l	DIc	RfDC	HQc	Cl	HIFl	l	DIl	SF	RISK
1	Aluminum	9.1E-01	1.6E-03	1	1.5E-03	NA	NA		0.0E+00		0.0E+00		ERR	9.1E-01	1.4E-04	1	1.3E-04	NA	NA
2	Antimony	2.4E-02	1.6E-03	1	3.9E-05	4.0E-04	1.0E-01							2.4E-02	1.4E-04	1	3.4E-06	NA	NA
3	Arsenic	1.7E-03	1.6E-03	1	2.7E-06	3.0E-04	9E-03							1.7E-03	1.4E-04	1	2.4E-07	1.8E+00	4E-07
4	Barium	3.2E-01	1.6E-03	1	5.2E-04	7.0E-02	7E-03							3.2E-01	1.4E-04	1	4.5E-05	NA	NA
5	Beryllium	1.6E-04	1.6E-03	1	2.6E-07	5.0E-03	5E-05							1.6E-04	1.4E-04	1	2.2E-08	4.3E+00	1.0E-0
6	Cadmium (food)	2.0E-02	1.6E-03	1	3.2E-05	NA	NA							2.0E-02	1.4E-04	1	2.8E-06	NA	NA
7	Chromium	8.5E-03	1.6E-03	1	1.4E-05	2.0E-02	7E-04							8.5E-03	1.4E-04	1	1.2E-06	NA	NA
8	Cobalt	5.8E-03	1.6E-03	1	9.2E-06	NA	NA							5.8E-03	1.4E-04	1	8.1E-07	NA	NA
9	Copper (b)	7.8E-01	1.6E-03	1	1.3E-03	3.7E-02	3E-02							7.8E-01	1.4E-04	1	1.1E-04	NA	NA
10	Lead	1.4E-02	1.6E-03	1	2.3E-05	NA	NA							1.4E-02	1.4E-04	1	2.0E-06	NA	NA
11	Mercury	1.4E-03	1.6E-03	1	2.2E-06	3.0E-04	7E-03							1.4E-03	1.4E-04	1	2.0E-07	NA	NA
12	Nickel	1.1E-01	1.6E-03	1	1.7E-04	2.0E-02	9E-03							1.1E-01	1.4E-04	1	1.5E-05	NA	NA
13	Silver	1.1E-02	1.6E-03	1	1.8E-05	5.0E-03	4E-03							1.1E-02	1.4E-04	1	1.6E-06	NA	NA
14	Vanadium	9.5E-03	1.6E-03	1	1.5E-05	7.0E-03	2E-03							9.5E-03	1.4E-04	1	1.3E-06	NA	NA
15	Cyanide	0.0E+00	1.6E-03	1	0.0E+00	2.0E-02	0E+00							0.0E+00	1.4E-04	1	0.0E+00	NA	NA
16	Ammonia-N	0.0E+00	1.6E-03	1	0.0E+00	9.7E-01	0E+00							0.0E+00	1.4E-04	1	0.0E+00	NA	NA
17	Nitrate+Nitrit	0.0E+00	1.6E-03	1	0.0E+00	1.0E-01	0E+00							0.0E+00	1.4E-04	1	0.0E+00	NA	NA
18	Acetone	8.0E-03	1.6E-03	1	1.3E-05	1.0E+00	1E-05							8.0E-03	1.4E-04	1	1.1E-06	NA	NA
19	Bromodichlorom	0.0E+00	1.6E-03	1	0.0E+00	2.0E-02	0E+00							0.0E+00	1.4E-04	1	0.0E+00	1.3E-01	0E+00
20	Butanone, 2-	0.0E+00	1.6E-03	1	0.0E+00	5.0E-01	0E+00							0.0E+00	1.4E-04	1	0.0E+00	NA	NA
21	Chlorobenzene	1.5E-04	1.6E-03	1	2.4E-07	2.0E-01	1E-06							1.5E-04	1.4E-04	1	2.1E-08	NA	NA
22	Chloroform	0.0E+00	1.6E-03	1	0.0E+00	1.0E-02	0E+00							0.0E+00	1.4E-04	1	0.0E+00	6.1E-03	0E+00
23	Dichloroethane	0.0E+00	1.6E-03	1	0.0E+00	1.0E+00	0E+00							0.0E+00	1.4E-04	1	0.0E+00	NA	NA
24	Dichloroethene	1.1E-03	1.6E-03	1	1.7E-06	9.0E-03	2E-04							1.1E-03	1.4E-04	1	1.5E-07	NA	NA
25	Ethylbenzene	7.8E-05	1.6E-03	1	1.2E-07	1.0E+00	1E-07							7.8E-05	1.4E-04	1	1.1E-08	NA	NA
26	Methyl-2-penta	5.5E-04	1.6E-03	1	8.7E-07	5.0E-01	2E-06							5.5E-04	1.4E-04	1	7.6E-08	NA	NA
27	Methylene chlo	8.7E-04	1.6E-03	1	1.4E-06	6.0E-02	2E-05							8.7E-04	1.4E-04	1	1.2E-07	7.5E-03	9E-10
28	Tetrachloroeth	9.5E-05	1.6E-03	1	1.5E-07	NA	NA							9.5E-05	1.4E-04	1	1.3E-08	2.0E-01	3E-09
29	Tetrachloroeth	6.9E-04	1.6E-03	1	1.1E-06	1.0E-01	1E-05							6.9E-04	1.4E-04	1	9.7E-08	5.2E-02	5E-09
30	Toluene	2.2E-04	1.6E-03	1	3.5E-07	2.0E+00	2E-07							2.2E-04	1.4E-04	1	3.0E-08	NA	NA
31	Trichloroethan	1.6E-04	1.6E-03	1	2.5E-07	9.0E-01	3E-07							1.6E-04	1.4E-04	1	2.2E-08	NA	NA
32	Trichloroethan	1.2E-04	1.6E-03	1	1.9E-07	4.0E-02	5E-06							1.2E-04	1.4E-04	1	1.6E-08	5.7E-02	9E-10
33	Trichloroethen	1.8E-02	1.6E-03	1	2.9E-05	NA	NA							1.8E-02	1.4E-04	1	2.5E-06	1.1E-02	3E-08
34	Vinyl acetate	0.0E+00	1.6E-03	1	0.0E+00	1.0E+00	0E+00							0.0E+00	1.4E-04	1	0.0E+00	NA	NA
35	Vinyl chloride	0.0E+00	1.6E-03	1	0.0E+00	NA	NA							0.0E+00	1.4E-04	1	0.0E+00	1.9E+00	0E+00
36	Xylenes (total	6.3E-05	1.6E-03	1	1.0E-07	4.0E+00	3E-08							6.3E-05	1.4E-04	1	8.8E-09	NA	NA
37	Bis(2-ethylhex	1.4E-02	1.6E-03	1	2.3E-05	2.0E-02	1E-03							1.4E-02	1.4E-04	1	2.0E-06	1.4E-02	3E-08
38	Di-n-butylphth	9.0E-03	1.6E-03	1	1.4E-05	1.0E+00	1E-05							9.0E-03	1.4E-04	1	1.3E-06	NA	NA

RANGE NAME: SSL..

SITE NAME: NI-MIL..
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP2
LAST UPDATED: 10/26/92

SUBCHRONIC EXPOSURE SUMMARY

Future
Resident Child

SUBCHRONIC DAILY INTAKE (mg/kg/day)

	CHEMICAL NAME	SCENARIO 1 On-site Groundwater Oral (FROM WS1)	SCENARIO 2 On-site Groundwater Dermal (FROM WS2)	SCENARIO 3 On-site Yard Soil Oral (FROM WS3)	SCENARIO 4 On-site Indoor Air Inhalation (FROM WS4)	SCENARIO 5 On-site Ambient Air Inhalation (FROM WS5)	SCENARIO 6 On-site Garden Veg. Oral (FROM WS6)
1	Aluminum	8.3E-03	1.7E-05	7.5E-02	0.0E+00	0.0E+00	1.5E-03
2	Antimony	9.7E-04	2.0E-06	4.2E-05	0.0E+00	0.0E+00	3.9E-05
3	Arsenic	1.6E-04	3.2E-07	1.5E-05	0.0E+00	0.0E+00	2.7E-06
4	Barium	2.1E-03	4.3E-06	9.2E-04	0.0E+00	0.0E+00	5.2E-04
5	Beryllium	1.9E-05	3.9E-08	5.5E-06	0.0E+00	0.0E+00	2.6E-07
6	Cadmium (food)	0.0E+00	NA	8.3E-06	0.0E+00	0.0E+00	3.2E-05
7	Chromium	2.6E-04	5.3E-07	1.4E-04	0.0E+00	0.0E+00	1.4E-05
8	Cobalt	2.7E-04	5.4E-07	5.5E-05	0.0E+00	0.0E+00	9.2E-06
9	Copper (b)	2.0E-04	4.1E-07	2.3E-04	0.0E+00	0.0E+00	1.3E-03
10	Lead	6.1E-05	1.2E-07	9.1E-05	0.0E+00	0.0E+00	2.3E-05
11	Mercury	1.4E-05	2.8E-08	4.2E-07	0.0E+00	0.0E+00	2.2E-06
12	Nickel	2.3E-03	4.7E-06	1.4E-04	0.0E+00	0.0E+00	1.7E-04
13	Silver	1.7E-04	3.5E-07	6.6E-06	0.0E+00	0.0E+00	1.0E-05
14	Vanadium	1.5E-04	3.1E-07	2.3E-04	0.0E+00	0.0E+00	1.5E-05
15	Cyanide	1.4E-03	2.8E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
16	Ammonia-N	3.8E-02	7.7E-05	0.0E+00	0.0E+00	0.0E+00	0.0E+00
17	Nitrate+Nitrit	6.1E-01	1.2E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00
18	Acetone	2.1E-03	2.4E-06	9.0E-08	2.8E-02	0.0E+00	1.3E-05
19	Bromodichlorom	6.6E-04	7.7E-06	0.0E+00	8.7E-03	0.0E+00	0.0E+00
20	Butanone, 2-	1.3E-03	1.4E-05	0.0E+00	1.8E-02	0.0E+00	0.0E+00
21	Chlorobenzene	0.0E+00	0.0E+00	3.1E-08	0.0E+00	3.3E-07	2.4E-07
22	Chloroform	6.6E-04	1.7E-04	0.0E+00	8.7E-03	0.0E+00	0.0E+00
23	Dichloroethane	6.6E-04	1.2E-05	0.0E+00	8.7E-03	0.0E+00	0.0E+00
24	Dichloroethene	3.0E-02	6.1E-04	1.4E-07	4.0E-01	0.0E+00	1.7E-06
25	Ethylbenzene	0.0E+00	0.0E+00	1.6E-08	0.0E+00	2.1E-07	1.2E-07
26	Methyl-2-penta	1.3E-03	8.6E-06	3.2E-08	1.7E-02	7.3E-08	8.7E-07
27	Methylene chlo	0.0E+00	0.0E+00	4.1E-08	0.0E+00	1.1E-06	1.4E-06
28	Tetrachloroeth	0.0E+00	0.0E+00	1.8E-08	0.0E+00	7.8E-08	1.5E-07
29	Tetrachloroeth	0.0E+00	0.0E+00	1.4E-07	0.0E+00	2.0E-06	1.1E-06
30	Toluene	6.6E-04	1.3E-03	4.4E-08	8.7E-03	1.3E-06	3.5E-07
31	Trichloroethan	6.6E-04	2.3E-05	3.0E-08	8.7E-03	7.2E-07	2.5E-07
32	Trichloroethan	0.0E+00	0.0E+00	1.8E-08	0.0E+00	1.4E-07	1.9E-07
33	Trichloroethen	1.3E-01	6.2E-02	3.3E-06	1.8E+00	5.2E-05	2.9E-05
34	Vinyl acetate	1.3E-03	1.7E-05	0.0E+00	1.7E-02	0.0E+00	0.0E+00
35	Vinyl chloride	2.3E-03	3.4E-05	0.0E+00	3.0E-02	0.0E+00	0.0E+00
36	Xylenes (total	6.6E-04	1.2E-04	1.3E-08	8.7E-03	1.7E-07	1.0E-07
37	Bis(2-ethylhex	0.0E+00	0.0E+00	1.3E-06	0.0E+00	0.0E+00	2.3E-05
38	Di-n-butylphth	1.9E-04	1.4E-04	1.4E-06	0.0E+00	0.0E+00	1.4E-05

SUBCHRONIC RISK SUMMARY

Future
Resident Child

SUBCHRONIC HAZARD QUOTIENT

	CHEMICAL NAME	SCENARIO 1 On-site Groundwater Oral (FROM WS1)	SCENARIO 2 On-site Groundwater Dermal (FROM WS2)	SCENARIO 3 On-site Yard Soil Oral (FROM WS3)	SCENARIO 4 On-site Indoor Air Inhalation (FROM WS4)	SCENARIO 5 On-site Ambient Air Inhalation (FROM WS5)	SCENARIO 6 On-site Garden Veg. Oral (FROM WS6)
1	Aluminum	NA	NA	NA	NA	NA	NA
2	Antimony	2E+00	5E-02	1E-01	NA	NA	1E-01
3	Arsenic	5E-01	1E-03	5E-02	NA	NA	9E-03
4	Barium	3E-02	6E-04	1E-02	0E+00	0E+00	7E-03
5	Beryllium	4E-03	2E-03	1E-03	NA	NA	5E-05
6	Cadmium (food)	NA	NA	NA	NA	NA	NA
7	Chromium	1E-02	5E-04	7E-03	NA	NA	7E-04
8	Cobalt	NA	NA	NA	NA	NA	NA
9	Copper (b)	5E-03	2E-05	6E-03	NA	NA	3E-02
10	Lead	NA	NA	NA	NA	NA	NA
11	Mercury	5E-02	5E-03	1E-03	NA	NA	7E-03
12	Nickel	1E-01	5E-03	7E-03	NA	NA	9E-03
13	Silver	3E-02	1E-03	1E-03	NA	NA	4E-03
14	Vanadium	2E-02	4E-03	3E-02	NA	NA	2E-03
15	Cyanide	7E-02	1E-04	0E+00	NA	NA	0E+00
16	Ammonia-N	4E-02	8E-05	0E+00	0E+00	0E+00	0E+00
17	Nitrate+Nitrit	6E+00	1E-02	0E+00	NA	NA	0E+00
18	Acetone	2E-03	2E-06	9E-08	NA	NA	1E-05
19	Bromodichlorom	3E-02	4E-04	0E+00	NA	NA	0E+00
20	Butanone, 2-	3E-03	3E-05	0E+00	2E-02	0E+00	0E+00
21	Chlorobenzene	0E+00	0E+00	2E-07	0E+00	7E-06	1E-06
22	Chloroform	7E-02	2E-02	0E+00	NA	NA	0E+00
23	Dichloroethane	7E-04	1E-05	0E+00	6E-03	0E+00	0E+00
24	Dichloroethene	3E+00	7E-02	2E-05	NA	NA	2E-04
25	Ethylbenzene	0E+00	0E+00	2E-08	0E+00	7E-07	1E-07
26	Methyl-2-penta	3E-03	2E-05	6E-08	7E-02	3E-07	2E-06
27	Methylene chlo	0E+00	0E+00	7E-07	0E+00	1E-06	2E-05
28	Tetrachloroeth	NA	NA	NA	NA	NA	NA
29	Tetrachloroeth	0E+00	0E+00	1E-06	NA	NA	1E-05
30	Toluene	3E-04	7E-04	2E-08	2E-02	2E-06	2E-07
31	Trichloroethan	7E-04	3E-05	3E-08	3E-03	2E-07	3E-07
32	Trichloroethan	0E+00	0E+00	4E-07	NA	NA	5E-06
33	Trichloroethen	NA	NA	NA	NA	NA	NA
34	Vinyl acetate	1E-03	2E-05	0E+00	3E-01	0E+00	0E+00
35	Vinyl chloride	NA	NA	NA	NA	NA	NA
36	Xylenes (total	2E-04	3E-05	3E-09	NA	NA	3E-08
37	Bis(2-ethylhex	0E+00	0E+00	7E-05	NA	NA	1E-03
38	Di-n-butylphth	2E-04	2E-04	1E-06	NA	NA	1E-05
	PATHWAY SUM (HI)	1E+01	2E-01	2E-01	4E-01	1E-05	2E-01
	POPULATION TOTAL	1E+01					

RANGE NAME: L.

SITE NAME: HI-M.
OPERABLE UNIT: DISK 2 (...VG)
FILE NAME: POP2
LAST UPDATED: 10/26/92

LIFETIME EXPOSURE SUMMARY

Future
Resident Child

LIFETIME AVERAGE DAILY INTAKE (mg/kg/day)

	CHEMICAL NAME	SCENARIO 1 On-site Groundwater Oral (FROM WS1)	SCENARIO 2 On-site Groundwater Dermal (FROM WS2)	SCENARIO 3 On-site Yard Soil Oral (FROM WS3)	SCENARIO 4 On-site Indoor Air Inhalation (FROM WS4)	SCENARIO 5 On-site Ambient Air Inhalation (FROM WS5)	SCENARIO 6 On-site Garden Veg. Oral (FROM WS6)
1	Aluminum	7.2E-04	1.4E-06	6.4E-03	0.0E+00	0.0E+00	1.3E-04
2	Antimony	8.4E-05	1.7E-07	3.6E-06	0.0E+00	0.0E+00	3.4E-06
3	Arsenic	1.4E-05	2.8E-08	1.3E-06	0.0E+00	0.0E+00	2.4E-07
4	Barium	1.9E-04	3.7E-07	7.9E-05	0.0E+00	0.0E+00	4.5E-05
5	Beryllium	1.7E-06	3.3E-09	4.7E-07	0.0E+00	0.0E+00	2.2E-08
6	Cadmium (food)	0.0E+00	NA	7.2E-07	0.0E+00	0.0E+00	2.8E-06
7	Chromium	2.3E-05	4.6E-08	1.2E-05	0.0E+00	0.0E+00	1.2E-06
8	Cobalt	2.3E-05	4.6E-08	4.7E-06	0.0E+00	0.0E+00	8.1E-07
9	Copper (b)	1.8E-05	3.5E-08	2.0E-05	0.0E+00	0.0E+00	1.1E-04
10	Lead	5.3E-06	1.1E-08	7.8E-06	0.0E+00	0.0E+00	2.0E-06
11	Mercury	1.2E-06	2.4E-09	3.6E-08	0.0E+00	0.0E+00	2.0E-07
12	Nickel	2.0E-04	4.1E-07	1.2E-05	0.0E+00	0.0E+00	1.5E-05
13	Silver	1.5E-05	3.0E-08	5.9E-07	0.0E+00	0.0E+00	1.6E-06
14	Vanadium	1.3E-05	2.6E-08	2.0E-05	0.0E+00	0.0E+00	1.3E-06
15	Cyanide	1.2E-04	2.4E-07	0.0E+00	0.0E+00	0.0E+00	0.0E+00
16	Ammonia-N	3.3E-03	6.6E-06	0.0E+00	0.0E+00	0.0E+00	0.0E+00
17	Nitrate+Nitrit	5.3E-02	1.1E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00
18	Acetone	1.8E-04	2.1E-07	7.7E-09	2.4E-03	0.0E+00	1.1E-06
19	Bromodichlorom	5.7E-05	6.6E-07	0.0E+00	7.6E-04	0.0E+00	0.0E+00
20	Butanone, 2-	1.2E-04	1.2E-06	0.0E+00	1.6E-03	0.0E+00	0.0E+00
21	Chlorobenzene	0.0E+00	0.0E+00	2.7E-09	0.0E+00	1.2E-08	2.1E-08
22	Chloroform	5.7E-05	1.5E-05	0.0E+00	7.6E-04	0.0E+00	0.0E+00
23	Dichloroethane	5.7E-05	1.1E-06	0.0E+00	7.6E-04	0.0E+00	0.0E+00
24	Dichloroethene	2.6E-03	5.2E-05	1.2E-08	1.5E-02	0.0E+00	1.5E-07
25	Ethylbenzene	0.0E+00	0.0E+00	1.4E-09	0.0E+00	7.8E-09	1.1E-08
26	Methyl-2-penta	1.1E-04	7.4E-07	2.8E-09	1.5E-03	2.8E-09	7.6E-08
27	Methylene chlo	0.0E+00	0.0E+00	3.5E-09	0.0E+00	4.3E-08	1.2E-07
28	Tetrachloroeth	0.0E+00	0.0E+00	1.5E-09	0.0E+00	1.0E-09	1.3E-08
29	Tetrachloroeth	0.0E+00	0.0E+00	1.2E-08	0.0E+00	7.3E-08	9.7E-08
30	Toluene	5.7E-05	1.1E-04	3.8E-09	7.6E-04	5.0E-08	3.0E-08
31	Trichloroethan	5.7E-05	1.9E-06	2.6E-09	7.6E-04	2.8E-08	2.2E-08
32	Trichloroethan	0.0E+00	0.0E+00	1.5E-09	0.0E+00	5.4E-09	1.6E-08
33	Trichloroethen	1.2E-02	5.3E-03	2.9E-07	1.5E-01	2.0E-06	2.5E-06
34	Vinyl acetate	1.1E-04	1.5E-06	0.0E+00	1.5E-03	0.0E+00	0.0E+00
35	Vinyl chloride	2.0E-04	2.9E-06	0.0E+00	2.7E-03	0.0E+00	0.0E+00
36	Xylenes (total	5.7E-05	1.0E-05	1.1E-09	7.6E-04	6.3E-09	8.8E-09
37	Bis(2-ethylhex	0.0E+00	0.0E+00	1.2E-07	0.0E+00	0.0E+00	2.0E-06
38	Di-n-butylphth	1.7E-05	1.2E-05	1.2E-07	0.0E+00	0.0E+00	1.3E-06

LIFETIME RISK SUMMARY

Future
Resident Child

LIFETIME EXCESS CANCER RISK

	CHEMICAL NAME	SCENARIO 1 On-site Groundwater Oral (FROM WS1)	SCENARIO 2 On-site Groundwater Dermal (FROM WS2)	SCENARIO 3 On-site Yard Soil Oral (FROM WS3)	SCENARIO 4 On-site Indoor Air Inhalation (FROM WS4)	SCENARIO 5 On-site Ambient Air Inhalation (FROM WS5)	SCENARIO 6 On-site Garden Veg. Oral (FROM WS6)
1	Aluminum	NA	NA	NA	NA	NA	NA
2	Antimony	NA	NA	NA	NA	NA	NA
3	Arsenic	2E-05	5E-08	2E-06	0E+00	0E+00	4E-07
4	Barium	NA	NA	NA	NA	NA	NA
5	Beryllium	7E-06	3E-06	2E-06	0E+00	0E+00	1E-07
6	Cadmium (food)	NA	NA	NA	0E+00	0E+00	NA
7	Chromium	NA	NA	NA	0E+00	0E+00	NA
8	Cobalt	NA	NA	NA	NA	NA	NA
9	Copper (b)	NA	NA	NA	NA	NA	NA
10	Lead	NA	NA	NA	NA	NA	NA
11	Mercury	NA	NA	NA	NA	NA	NA
12	Nickel	NA	NA	NA	0E+00	0E+00	NA
13	Silver	NA	NA	NA	NA	NA	NA
14	Vanadium	NA	NA	NA	NA	NA	NA
15	Cyanide	NA	NA	NA	NA	NA	NA
16	Ammonia-N	NA	NA	NA	NA	NA	NA
17	Nitrate+Nitrit	NA	NA	NA	NA	NA	NA
18	Acetone	NA	NA	NA	NA	NA	NA
19	Bromodichlorom	7E-06	9E-08	0E+00	NA	NA	0E+00
20	Butanone, 2-	NA	NA	NA	NA	NA	NA
21	Chlorobenzene	NA	NA	NA	NA	NA	NA
22	Chloroform	3E-07	9E-08	0E+00	6E-05	0E+00	0E+00
23	Dichloroethane	NA	NA	NA	NA	NA	NA
24	Dichloroethene	NA	NA	NA	NA	NA	NA
25	Ethylbenzene	NA	NA	NA	NA	NA	NA
26	Methyl-2-penta	NA	NA	NA	NA	NA	NA
27	Methylene chlo	0E+00	0E+00	3E-11	0E+00	7E-11	9E-10
28	Tetrachloroeth	0E+00	0E+00	3E-10	0E+00	6E-10	3E-09
29	Tetrachloroeth	0E+00	0E+00	6E-10	0E+00	1E-10	5E-09
30	Toluene	NA	NA	NA	NA	NA	NA
31	Trichloroethan	NA	NA	NA	NA	NA	NA
32	Trichloroethan	0E+00	0E+00	9E-11	0E+00	3E-10	9E-10
33	Trichloroethen	1E-04	6E-05	3E-09	9E-04	1E-08	3E-08
34	Vinyl acetate	NA	NA	NA	NA	NA	NA
35	Vinyl chloride	4E-04	6E-06	0E+00	8E-04	0E+00	0E+00
36	Xylenes (total	NA	NA	NA	NA	NA	NA
37	Bis(2-ethylhex	0E+00	0E+00	2E-09	NA	NA	3E-08
38	Di-n-butylphth	NA	NA	NA	NA	NA	NA
	TOTAL PATHWAY CANCER RISK	5E-04	7E-05	4E-06	2E-03	1E-08	6E-07

POPULATION TOTAL EXCESS RISK 3E-03

RANGE NAME: W61

EXPOSURE AND RISK CALCULATION WORKSHEET

SITE NAME: BI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP3
LAST UPDATED: 10/26/92

LAND USE: Future
POPULATION: Resident Youngster

EXPOSURE POINT: Target Pond
MEDIUM: Surface Water
ROUTE: Oral

HIFs = 0.0E+00
HIFc = 2.1E-05
HIFl = 3.0E-06

		SUBCHRONIC					CHRONIC						LIFETIME					
	CHEMICAL NAME	Cs	HIFs	1	DIs	RfDS	HQs	Cc	HIFc	1	DIc	RfDC	HQc	Cl	HIFl	1	DIl	SF	RISK
1	Aluminum		0.0E+00		0.0E+00		ERR	2.3E+00	2.1E-05	1	4.8E-05	NA	NA	2.3E+00	3.0E-06	1	6.8E-06	NA	NA
2	Antimony							0.0E+00	2.1E-05	1	0.0E+00	4.0E-04	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
3	Arsenic							0.0E+00	2.1E-05	1	0.0E+00	3.0E-04	0E+00	0.0E+00	3.0E-06	1	0.0E+00	1.8E+00	0E+00
4	Barium							0.0E+00	2.1E-05	1	0.0E+00	7.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
5	Beryllium							0.0E+00	2.1E-05	1	0.0E+00	5.0E-03	0E+00	0.0E+00	3.0E-06	1	0.0E+00	4.3E+00	0E+00
6	Cadmium (food)							0.0E+00	2.1E-05	1	0.0E+00	1.0E-03	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
7	Chromium							1.1E-02	2.1E-05	1	2.2E-07	5.0E-03	4E-05	1.1E-02	3.0E-06	1	3.2E-06	NA	NA
8	Cobalt							0.0E+00	2.1E-05	1	0.0E+00	NA	NA	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
9	Copper (b)							0.0E+00	2.1E-05	1	0.0E+00	3.7E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
10	Lead							4.3E-03	2.1E-05	1	8.9E-08	NA	NA	4.3E-03	3.0E-06	1	1.3E-08	NA	NA
11	Mercury							0.0E+00	2.1E-05	1	0.0E+00	3.0E-04	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
12	Nickel							2.5E-01	2.1E-05	1	5.2E-06	2.0E-02	3E-04	2.5E-01	3.0E-06	1	7.4E-07	NA	NA
13	Silver							7.7E-03	2.1E-05	1	1.6E-07	5.0E-03	3E-05	7.7E-03	3.0E-06	1	2.3E-08	NA	NA
14	Vanadium							0.0E+00	2.1E-05	1	0.0E+00	7.0E-03	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
15	Cyanide							0.0E+00	2.1E-05	1	0.0E+00	2.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
16	Ammonia-N							0.0E+00	2.1E-05	1	0.0E+00	9.7E-01	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
17	Nitrate+Nitrite							0.0E+00	2.1E-05	1	0.0E+00	1.0E-01	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
18	Acetone							0.0E+00	2.1E-05	1	0.0E+00	1.0E-01	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
19	Bromodichloromethane							0.0E+00	2.1E-05	1	0.0E+00	2.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	1.3E-01	0E+00
20	Butanone, 2-							0.0E+00	2.1E-05	1	0.0E+00	5.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
21	Chlorobenzene							0.0E+00	2.1E-05	1	0.0E+00	2.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
22	Chloroform							0.0E+00	2.1E-05	1	0.0E+00	1.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	6.1E-03	0E+00
23	Dichloroethane, 1,1-							0.0E+00	2.1E-05	1	0.0E+00	1.0E-01	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
24	Dichloroethene, 1,2- (total)							0.0E+00	2.1E-05	1	0.0E+00	9.0E-03	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
25	Ethylbenzene							0.0E+00	2.1E-05	1	0.0E+00	1.0E-01	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
26	Methyl-2-pentanone, 4-							0.0E+00	2.1E-05	1	0.0E+00	5.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
27	Methylene chloride							0.0E+00	2.1E-05	1	0.0E+00	6.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	7.5E-03	0E+00
28	Tetrachloroethane, 1,1,2,2-							0.0E+00	2.1E-05	1	0.0E+00	NA	NA	0.0E+00	3.0E-06	1	0.0E+00	2.0E-01	0E+00
29	Tetrachloroethene							0.0E+00	2.1E-05	1	0.0E+00	1.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	5.2E-02	0E+00
30	Toluene							0.0E+00	2.1E-05	1	0.0E+00	2.0E-01	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
31	Trichloroethane, 1,1,1-							0.0E+00	2.1E-05	1	0.0E+00	9.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
32	Trichloroethane, 1,1,2-							0.0E+00	2.1E-05	1	0.0E+00	4.0E-03	0E+00	0.0E+00	3.0E-06	1	0.0E+00	5.7E-02	0E+00
33	Trichloroethene (c)							0.0E+00	2.1E-05	1	0.0E+00	6.0E-03	0E+00	0.0E+00	3.0E-06	1	0.0E+00	1.1E-02	0E+00
34	Vinyl acetate							0.0E+00	2.1E-05	1	0.0E+00	2.0E-01	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
35	Vinyl chloride							0.0E+00	2.1E-05	1	0.0E+00	NA	NA	0.0E+00	3.0E-06	1	0.0E+00	1.9E+00	0E+00
36	Xylenes (total)							0.0E+00	2.1E-05	1	0.0E+00	2.0E+00	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA
37	Bis(2-ethylhexyl)phthalate							0.0E+00	2.1E-05	1	0.0E+00	2.0E-02	0E+00	0.0E+00	3.0E-06	1	0.0E+00	1.4E-02	0E+00
38	Di-n-butylphthalate							0.0E+00	2.1E-05	1	0.0E+00	1.0E-01	0E+00	0.0E+00	3.0E-06	1	0.0E+00	NA	NA

RANGE NAME: NA

EXPOSURE AND RISK CALCULATION WORKSHEET

SITE NAME: BI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP3
LAST UPDATED: 10/26/92

LAND USE: Future
POPULATION: Resident Youngster

EXPOSURE POINT: Target Pond
MEDIUM: Surface Water
ROUTE: Dermal

HIFs = 0.0E+00
HIFc = 5.4E-03
HIFl = 7.7E-04

		SUBCHRONIC					CHRONIC						LIFETIME					
	CHEMICAL NAME	Cs	HIFs	P	DIs	RfDS	HQs	Cc	HIFc	P	DIc	RfDC	HQc	Cl	HIFl	P	DIl	SF	RISK
1	Aluminum		0.0E+00		0.0E+00		ERR	2.3E+00	5.4E-03	1.0E-03	1.2E-05	NA	NA	2.3E+00	7.7E-04	1.0E-03	1.0E-06	NA	NA
2	Antimony							0.0E+00	5.4E-03	1.0E-03	0.0E+00	4.0E-05	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
3	Arsenic							0.0E+00	5.4E-03	1.0E-03	0.0E+00	2.9E-04	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	1.8E+00	0E+00
4	Barium							0.0E+00	5.4E-03	1.0E-03	0.0E+00	7.0E-03	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
5	Beryllium							0.0E+00	5.4E-03	1.0E-03	0.0E+00	2.5E-05	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	8.6E+02	0E+00
6	Cadmium (food)							0.0E+00	5.4E-03	NA	NA	2.5E-05	NA	0.0E+00	7.7E-04	NA	NA	NA	NA
7	Chromium							1.1E-02	5.4E-03	1.0E-03	5.7E-08	2.5E-04	2E-04	1.1E-02	7.7E-04	1.0E-03	8.2E-09	NA	NA
8	Cobalt							0.0E+00	5.4E-03	1.0E-03	0.0E+00	NA	NA	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
9	Copper (b)							0.0E+00	5.4E-03	1.0E-03	0.0E+00	1.9E-02	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
10	Lead							4.3E-03	5.4E-03	1.0E-03	2.3E-08	NA	NA	4.3E-03	7.7E-04	1.0E-03	3.3E-09	NA	NA
11	Mercury							0.0E+00	5.4E-03	1.0E-03	0.0E+00	6.0E-06	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
12	Nickel							2.5E-01	5.4E-03	1.0E-03	1.3E-06	1.0E-03	1E-03	2.5E-01	7.7E-04	1.0E-03	1.9E-07	NA	NA
13	Silver							7.7E-03	5.4E-03	1.0E-03	4.2E-08	2.5E-04	2E-04	7.7E-03	7.7E-04	1.0E-03	5.9E-09	NA	NA
14	Vanadium							0.0E+00	5.4E-03	1.0E-03	0.0E+00	7.0E-05	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
15	Cyanide							0.0E+00	5.4E-03	1.0E-03	0.0E+00	2.0E-02	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
16	Ammonia-N							0.0E+00	5.4E-03	1.0E-03	0.0E+00	9.7E-01	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
17	Nitrate+Nitrite							0.0E+00	5.4E-03	1.0E-03	0.0E+00	1.0E-01	0E+00	0.0E+00	7.7E-04	1.0E-03	0.0E+00	NA	NA
18	Acetone							0.0E+00	5.4E-03	5.7E-04	0.0E+00	1.0E-01	0E+00	0.0E+00	7.7E-04	5.7E-04	0.0E+00	NA	NA
19	Bromodichloromethane							0.0E+00	5.4E-03	5.0E-03	0.0E+00	2.0E-02	0E+00	0.0E+00	7.7E-04	5.0E-03	0.0E+00	1.3E-01	0E+00
20	Butanone, 2-							0.0E+00	5.4E-03	5.0E-03	0.0E+00	5.0E-02	0E+00	0.0E+00	7.7E-04	5.0E-03	0.0E+00	NA	NA
21	Chlorobenzene							0.0E+00	5.4E-03	4.1E-02	0.0E+00	2.0E-02	0E+00	0.0E+00	7.7E-04	4.1E-02	0.0E+00	NA	NA
22	Chloroform							0.0E+00	5.4E-03	1.3E-01	0.0E+00	1.0E-02	0E+00	0.0E+00	7.7E-04	1.3E-01	0.0E+00	6.1E-03	0E+00
23	Dichloroethane, 1,1-							0.0E+00	5.4E-03	9.2E-03	0.0E+00	1.0E-01	0E+00	0.0E+00	7.7E-04	9.2E-03	0.0E+00	NA	NA
24	Dichloroethene, 1,2- (total)							0.0E+00	5.4E-03	1.0E-02	0.0E+00	9.0E-03	0E+00	0.0E+00	7.7E-04	1.0E-02	0.0E+00	NA	NA
25	Ethylbenzene							0.0E+00	5.4E-03	1.0E+00	0.0E+00	8.2E-02	0E+00	0.0E+00	7.7E-04	1.0E+00	0.0E+00	NA	NA
26	Methyl-2-pentanone, 4-							0.0E+00	5.4E-03	3.3E-03	0.0E+00	5.0E-02	0E+00	0.0E+00	7.7E-04	3.3E-03	0.0E+00	NA	NA
27	Methylene chloride							0.0E+00	5.4E-03	4.8E-03	0.0E+00	6.0E-02	0E+00	0.0E+00	7.7E-04	4.8E-03	0.0E+00	7.5E-03	0E+00
28	Tetrachloroethane, 1,1,2,2-							0.0E+00	5.4E-03	9.0E-03	0.0E+00	NA	NA	0.0E+00	7.7E-04	9.0E-03	0.0E+00	2.0E-01	0E+00
29	Tetrachloroethene							0.0E+00	5.4E-03	3.7E-01	0.0E+00	1.0E-02	0E+00	0.0E+00	7.7E-04	3.7E-01	0.0E+00	5.2E-02	0E+00
30	Toluene							0.0E+00	5.4E-03	1.0E+00	0.0E+00	2.0E-01	0E+00	0.0E+00	7.7E-04	1.0E+00	0.0E+00	NA	NA
31	Trichloroethane, 1,1,1-							0.0E+00	5.4E-03	1.7E-02	0.0E+00	9.0E-02	0E+00	0.0E+00	7.7E-04	1.7E-02	0.0E+00	NA	NA
32	Trichloroethane, 1,1,2-							0.0E+00	5.4E-03	8.4E-03	0.0E+00	4.0E-03	0E+00	0.0E+00	7.7E-04	8.4E-03	0.0E+00	5.7E-02	0E+00
33	Trichloroethene (c)							0.0E+00	5.4E-03	2.3E-01	0.0E+00	6.0E-03	0E+00	0.0E+00	7.7E-04	2.3E-01	0.0E+00	1.1E-02	0E+00
34	Vinyl acetate							0.0E+00	5.4E-03	6.6E-03	0.0E+00	2.0E-01	0E+00	0.0E+00	7.7E-04	6.6E-03	0.0E+00	NA	NA
35	Vinyl chloride							0.0E+00	5.4E-03	7.3E-03	0.0E+00	NA	NA	0.0E+00	7.7E-04	7.3E-03	0.0E+00	2.1E+00	0E+00
36	Xylenes (total)							0.0E+00	5.4E-03	8.9E-02	0.0E+00	2.0E+00	0E+00	0.0E+00	7.7E-04	8.9E-02	0.0E+00	NA	NA
37	Bis(2-ethylhexyl)phthalate							0.0E+00	5.4E-03	7.5E-03	0.0E+00	2.0E-02	0E+00	0.0E+00	7.7E-04	7.5E-03	0.0E+00	1.4E-02	0E+00
38	Di-n-butylphthalate							0.0E+00	5.4E-03	3.6E-01	0.0E+00	8.5E-02	0E+00	0.0E+00	7.7E-04	3.6E-01	0.0E+00	NA	NA

RANGE NAME: WS3

EXPOSURE AND RISK CALCULATION WORKSHEET

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP3
LAST UPDATED: 10/26/92

LAND USE: Future
POPULATION: Resident Youngster

EXPOSURE POINT: Target Pond
MEDIUM: Sediment
ROUTE: Oral

HIFs = 0.0E+00
HIFc = 4.1E-08
HIFl = 5.9E-09

		SUBCHRONIC					CHRONIC						LIFETIME					
	CHEMICAL NAME	Cs	HIFs	l	DIs	RfDS	HQs	Cc	HIFc	l	DIc	RfDC	HQc	Cl	HIFl	l	DIl	SF	RISK
1	Aluminum		0.0E+00		0.0E+00		ERR	2.2E+04	4.1E-08	1	9.1E-04	NA	NA	2.2E+04	5.9E-09	1	1.3E-04	NA	NA
2	Antimony							0.0E+00	4.1E-08	1	0.0E+00	4.0E-04	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
3	Arsenic							5.4E+00	4.1E-08	1	2.2E-07	3.0E-04	7E-04	5.4E+00	5.9E-09	1	3.2E-08	1.8E+00	6E-08
4	Barium							2.3E+02	4.1E-08	1	9.3E-06	7.0E-02	1E-04	2.3E+02	5.9E-09	1	1.3E-06	NA	NA
5	Beryllium							1.3E+00	4.1E-08	1	5.2E-08	5.0E-03	1E-05	1.3E+00	5.9E-09	1	7.5E-09	4.3E+00	3E-08
6	Cadmium (food)							4.1E+00	4.1E-08	1	1.7E-07	1.0E-03	2E-04	4.1E+00	5.9E-09	1	2.4E-08	NA	NA
7	Chromium							6.0E+02	4.1E-08	1	2.5E-05	5.0E-03	5E-03	6.0E+02	5.9E-09	1	3.6E-06	NA	NA
8	Cobalt							8.9E+00	4.1E-08	1	3.6E-07	NA	NA	8.9E+00	5.9E-09	1	5.2E-08	NA	NA
9	Copper (b)							3.6E+03	4.1E-08	1	1.5E-04	3.7E-02	4E-03	3.6E+03	5.9E-09	1	2.1E-05	NA	NA
10	Lead							9.8E+01	4.1E-08	1	4.0E-06	NA	NA	9.8E+01	5.9E-09	1	5.8E-07	NA	NA
11	Mercury							4.9E-01	4.1E-08	1	2.0E-08	3.0E-04	7E-05	4.9E-01	5.9E-09	1	2.9E-09	NA	NA
12	Nickel							2.7E+01	4.1E-08	1	1.1E-06	2.0E-02	6E-05	2.7E+01	5.9E-09	1	1.6E-07	NA	NA
13	Silver							2.1E+00	4.1E-08	1	8.5E-08	5.0E-03	2E-05	2.1E+00	5.9E-09	1	1.2E-08	NA	NA
14	Vanadium							4.0E+01	4.1E-08	1	1.6E-06	7.0E-03	2E-04	4.0E+01	5.9E-09	1	2.4E-07	NA	NA
15	Cyanide							0.0E+00	4.1E-08	1	0.0E+00	2.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
16	Ammonia-N							0.0E+00	4.1E-08	1	0.0E+00	9.7E-01	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
17	Nitrate+Nitrite							0.0E+00	4.1E-08	1	0.0E+00	1.0E-01	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
18	Acetone							0.0E+00	4.1E-08	1	0.0E+00	1.0E-01	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
19	Bromodichloromethane							0.0E+00	4.1E-08	1	0.0E+00	2.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	1.3E-01	0E+00
20	Butanone, 2-							0.0E+00	4.1E-08	1	0.0E+00	5.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
21	Chlorobenzene							0.0E+00	4.1E-08	1	0.0E+00	2.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
22	Chloroform							0.0E+00	4.1E-08	1	0.0E+00	1.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	6.1E-03	0E+00
23	Dichloroethane, 1,1-							0.0E+00	4.1E-08	1	0.0E+00	1.0E-01	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
24	Dichloroethene, 1,2- (total)							0.0E+00	4.1E-08	1	0.0E+00	9.0E-03	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
25	Ethylbenzene							0.0E+00	4.1E-08	1	0.0E+00	1.0E-01	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
26	Methyl-2-pentanone, 4-							0.0E+00	4.1E-08	1	0.0E+00	5.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
27	Methylene chloride							0.0E+00	4.1E-08	1	0.0E+00	6.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	7.5E-03	0E+00
28	Tetrachloroethane, 1,1,2,2-							0.0E+00	4.1E-08	1	0.0E+00	NA	NA	0.0E+00	5.9E-09	1	0.0E+00	2.0E-01	0E+00
29	Tetrachloroethene							0.0E+00	4.1E-08	1	0.0E+00	1.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	5.2E-02	0E+00
30	Toluene							0.0E+00	4.1E-08	1	0.0E+00	2.0E-01	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
31	Trichloroethane, 1,1,1-							0.0E+00	4.1E-08	1	0.0E+00	9.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
32	Trichloroethane, 1,1,2-							0.0E+00	4.1E-08	1	0.0E+00	4.0E-03	0E+00	0.0E+00	5.9E-09	1	0.0E+00	5.7E-02	0E+00
33	Trichloroethene (c)							0.0E+00	4.1E-08	1	0.0E+00	6.0E-03	0E+00	0.0E+00	5.9E-09	1	0.0E+00	1.1E-02	0E+00
34	Vinyl acetate							0.0E+00	4.1E-08	1	0.0E+00	2.0E-01	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
35	Vinyl chloride							0.0E+00	4.1E-08	1	0.0E+00	NA	NA	0.0E+00	5.9E-09	1	0.0E+00	1.9E+00	0E+00
36	Xylenes (total)							0.0E+00	4.1E-08	1	0.0E+00	2.0E+00	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA
37	Bis(2-ethylhexyl)phthalate							0.0E+00	4.1E-08	1	0.0E+00	2.0E-02	0E+00	0.0E+00	5.9E-09	1	0.0E+00	1.4E-02	0E+00
38	Di-n-butylphthalate							0.0E+00	4.1E-08	1	0.0E+00	1.0E-01	0E+00	0.0E+00	5.9E-09	1	0.0E+00	NA	NA

RANGE NAME: CSUM

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP3
LAST UPDATED: 10/26/92

CHRONIC EXPOSURE SUMMARY

Future
Resident Youngster

CHRONIC DAILY INTAKE (mg/kg/day)

	CHEMICAL NAME	SCENARIO 1 Target Pond Surface Wat Oral (FROM WS1)	SCENARIO 2 Target Pond Surface Wat Dermal (FROM WS2)	SCENARIO 3 Target Pond Sediment Oral (FROM WS3)	SCENARIO 4 0 0 0 (FROM WS4)	SCENARIO 5 0 0 0 (FROM WS5)	SCENARIO 6 0 0 0 (FROM WS6)
1	Aluminum	4.8E-05	1.2E-05	9.1E-04	0.0E+00	0.0E+00	0.0E+00
2	Antimony	0.0E+00	0.0E+00	0.0E+00			
3	Arsenic	0.0E+00	0.0E+00	2.2E-07			
4	Barium	0.0E+00	0.0E+00	9.3E-06			
5	Beryllium	0.0E+00	0.0E+00	5.2E-08			
6	Cadmium (food)	0.0E+00	NA	1.7E-07			
7	Chromium	2.2E-07	5.7E-08	2.5E-05			
8	Cobalt	0.0E+00	0.0E+00	3.6E-07			
9	Copper (b)	0.0E+00	0.0E+00	1.5E-04			
10	Lead	8.9E-08	2.3E-08	4.0E-06			
11	Mercury	0.0E+00	0.0E+00	2.0E-08			
12	Nickel	5.2E-06	1.3E-06	1.1E-06			
13	Silver	1.6E-07	4.2E-08	8.5E-08			
14	Vanadium	0.0E+00	0.0E+00	1.6E-06			
15	Cyanide	0.0E+00	0.0E+00	0.0E+00			
16	Ammonia-N	0.0E+00	0.0E+00	0.0E+00			
17	Nitrate+Nitrit	0.0E+00	0.0E+00	0.0E+00			
18	Acetone	0.0E+00	0.0E+00	0.0E+00			
19	Bromodichlorom	0.0E+00	0.0E+00	0.0E+00			
20	Butanone, 2-	0.0E+00	0.0E+00	0.0E+00			
21	Chlorobenzene	0.0E+00	0.0E+00	0.0E+00			
22	Chloroform	0.0E+00	0.0E+00	0.0E+00			
23	Dichloroethane	0.0E+00	0.0E+00	0.0E+00			
24	Dichloroethene	0.0E+00	0.0E+00	0.0E+00			
25	Ethylbenzene	0.0E+00	0.0E+00	0.0E+00			
26	Methyl-2-penta	0.0E+00	0.0E+00	0.0E+00			
27	Methylene chlo	0.0E+00	0.0E+00	0.0E+00			
28	Tetrachloroeth	0.0E+00	0.0E+00	0.0E+00			
29	Tetrachloroeth	0.0E+00	0.0E+00	0.0E+00			
30	Toluene	0.0E+00	0.0E+00	0.0E+00			
31	Trichloroethan	0.0E+00	0.0E+00	0.0E+00			
32	Trichloroethan	0.0E+00	0.0E+00	0.0E+00			
33	Trichloroethen	0.0E+00	0.0E+00	0.0E+00			
34	Vinyl acetate	0.0E+00	0.0E+00	0.0E+00			
35	Vinyl chloride	0.0E+00	0.0E+00	0.0E+00			
36	Xylenes (total	0.0E+00	0.0E+00	0.0E+00			
37	Bis(2-ethylhex	0.0E+00	0.0E+00	0.0E+00			
38	Di-n-butylphth	0.0E+00	0.0E+00	0.0E+00			
				PATHWAY SUM (HI)			
				POPULATION TOTAL			

CHRONIC RISK SUMMARY

Future
Resident Youngster

CHRONIC HAZARD QUOTIENT

	CHEMICAL NAME	SCENARIO 1 Target Pond Surface Wat Oral (FROM WS1)	SCENARIO 2 Target Pond Surface Wat Dermal (FROM WS2)	SCENARIO 3 Target Pond Sediment Oral (FROM WS3)	SCENARIO 4 0 0 0 (FROM WS4)	SCENARIO 5 0 0 0 (FROM WS5)	SCENARIO 6 0 0 0 (FROM WS6)
1	Aluminum	NA	NA	NA	0E+00	0E+00	0E+00
2	Antimony	0E+00	0E+00	0E+00			
3	Arsenic	0E+00	0E+00	7E-04			
4	Barium	0E+00	0E+00	1E-04			
5	Beryllium	0E+00	0E+00	1E-05			
6	Cadmium (food)	0E+00	NA	2E-04			
7	Chromium	4E-05	2E-04	5E-03			
8	Cobalt	NA	NA	NA			
9	Copper (b)	0E+00	0E+00	4E-03			
10	Lead	NA	NA	NA			
11	Mercury	0E+00	0E+00	7E-05			
12	Nickel	3E-04	1E-03	6E-05			
13	Silver	3E-05	2E-04	2E-05			
14	Vanadium	0E+00	0E+00	2E-04			
15	Cyanide	0E+00	0E+00	0E+00			
16	Ammonia-N	0E+00	0E+00	0E+00			
17	Nitrate+Nitrit	0E+00	0E+00	0E+00			
18	Acetone	0E+00	0E+00	0E+00			
19	Bromodichlorom	0E+00	0E+00	0E+00			
20	Butanone, 2-	0E+00	0E+00	0E+00			
21	Chlorobenzene	0E+00	0E+00	0E+00			
22	Chloroform	0E+00	0E+00	0E+00			
23	Dichloroethane	0E+00	0E+00	0E+00			
24	Dichloroethene	0E+00	0E+00	0E+00			
25	Ethylbenzene	0E+00	0E+00	0E+00			
26	Methyl-2-penta	0E+00	0E+00	0E+00			
27	Methylene chlo	0E+00	0E+00	0E+00			
28	Tetrachloroeth	NA	NA	NA			
29	Tetrachloroeth	0E+00	0E+00	0E+00			
30	Toluene	0E+00	0E+00	0E+00			
31	Trichloroethan	0E+00	0E+00	0E+00			
32	Trichloroethan	0E+00	0E+00	0E+00			
33	Trichloroethen	0E+00	0E+00	0E+00			
34	Vinyl acetate	0E+00	0E+00	0E+00			
35	Vinyl chloride	NA	NA	NA			
36	Xylenes (total	0E+00	0E+00	0E+00			
37	Bis(2-ethylhex	0E+00	0E+00	0E+00			
38	Di-n-butylphth	0E+00	0E+00	0E+00			
		4E-04	1E-03	1E-02	0E+00	0E+00	0E+00
		1E-02					

RANGE NAME: LSUM

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (Ave)
FILE NAME: POP3
LAST UPDATED: 10/26/92

LIFETIME EXPOSURE SUMMARY

Future
Resident Youngster

LIFETIME AVERAGE DAILY INTAKE (mg/kg/day)

	CHEMICAL NAME	SCENARIO 1 Target Pond Surface Wat Oral (FROM WS1)	SCENARIO 2 Target Pond Surface Wat Dermal (FROM WS2)	SCENARIO 3 Target Pond Sediment Oral (FROM WS3)	SCENARIO 4 0 0 0 (FROM WS4)	SCENARIO 5 0 0 0 (FROM WS5)	SCENARIO 6 0 0 0 (FROM WS6)
1	Aluminum	6.6E-06	1.8E-06	1.3E-04	0.0E+00	0.0E+00	0.0E+00
2	Antimony	0.0E+00	0.0E+00	0.0E+00			
3	Arsenic	0.0E+00	0.0E+00	3.2E-08			
4	Barium	0.0E+00	0.0E+00	1.3E-06			
5	Beryllium	0.0E+00	0.0E+00	7.5E-09			
6	Cadmium (food)	0.0E+00	NA	2.4E-08			
7	Chromium	3.2E-08	8.2E-09	3.6E-06			
8	Cobalt	0.0E+00	0.0E+00	5.2E-08			
9	Copper (b)	0.0E+00	0.0E+00	2.1E-05			
10	Lead	1.3E-08	3.3E-09	5.8E-07			
11	Mercury	0.0E+00	0.0E+00	2.9E-09			
12	Nickel	7.4E-07	1.9E-07	1.6E-07			
13	Silver	2.3E-08	5.9E-09	1.2E-08			
14	Vanadium	0.0E+00	0.0E+00	2.4E-07			
15	Cyanide	0.0E+00	0.0E+00	0.0E+00			
16	Ammonia-N	0.0E+00	0.0E+00	0.0E+00			
17	Nitrate+Nitrit	0.0E+00	0.0E+00	0.0E+00			
18	Acetone	0.0E+00	0.0E+00	0.0E+00			
19	Bromodichlorom	0.0E+00	0.0E+00	0.0E+00			
20	Butanone, 2-	0.0E+00	0.0E+00	0.0E+00			
21	Chlorobenzene	0.0E+00	0.0E+00	0.0E+00			
22	Chloroform	0.0E+00	0.0E+00	0.0E+00			
23	Dichloroethane	0.0E+00	0.0E+00	0.0E+00			
24	Dichloroethene	0.0E+00	0.0E+00	0.0E+00			
25	Ethylbenzene	0.0E+00	0.0E+00	0.0E+00			
26	Methyl-2-penta	0.0E+00	0.0E+00	0.0E+00			
27	Methylene chlo	0.0E+00	0.0E+00	0.0E+00			
28	Tetrachloroeth	0.0E+00	0.0E+00	0.0E+00			
29	Tetrachloroeth	0.0E+00	0.0E+00	0.0E+00			
30	Toluene	0.0E+00	0.0E+00	0.0E+00			
31	Trichloroethan	0.0E+00	0.0E+00	0.0E+00			
32	Trichloroethan	0.0E+00	0.0E+00	0.0E+00			
33	Trichloroethen	0.0E+00	0.0E+00	0.0E+00			
34	Vinyl acetate	0.0E+00	0.0E+00	0.0E+00			
35	Vinyl chloride	0.0E+00	0.0E+00	0.0E+00			
36	Xylenes (total	0.0E+00	0.0E+00	0.0E+00			
37	Bis(2-ethylhex	0.0E+00	0.0E+00	0.0E+00			
38	Di-n-butylphth	0.0E+00	0.0E+00	0.0E+00			

LIFETIME RISK SUMMARY

Future
Resident Youngster

LIFETIME EXCESS CANCER RISK

	CHEMICAL NAME	SCENARIO 1 Target Pond Surface Wat Oral (FROM WS1)	SCENARIO 2 Target Pond Surface Wat Dermal (FROM WS2)	SCENARIO 3 Target Pond Sediment Oral (FROM WS3)	SCENARIO 4 0 0 0 (FROM WS4)	SCENARIO 5 0 0 0 (FROM WS5)	SCENARIO 6 0 0 0 (FROM WS6)
1	Aluminum	NA	NA	NA	0E+00	0E+00	0E+00
2	Antimony	NA	NA	NA			
3	Arsenic	0E+00	0E+00	6E-08			
4	Barium	NA	NA	NA			
5	Beryllium	0E+00	0E+00	3E-08			
6	Cadmium (food)	NA	NA	NA			
7	Chromium	NA	NA	NA			
8	Cobalt	NA	NA	NA			
9	Copper (b)	NA	NA	NA			
10	Lead	NA	NA	NA			
11	Mercury	NA	NA	NA			
12	Nickel	NA	NA	NA			
13	Silver	NA	NA	NA			
14	Vanadium	NA	NA	NA			
15	Cyanide	NA	NA	NA			
16	Ammonia-N	NA	NA	NA			
17	Nitrate+Nitrit	NA	NA	NA			
18	Acetone	NA	NA	NA			
19	Bromodichlorom	0E+00	0E+00	0E+00			
20	Butanone, 2-	NA	NA	NA			
21	Chlorobenzene	NA	NA	NA			
22	Chloroform	0E+00	0E+00	0E+00			
23	Dichloroethane	NA	NA	NA			
24	Dichloroethene	NA	NA	NA			
25	Ethylbenzene	NA	NA	NA			
26	Methyl-2-penta	NA	NA	NA			
27	Methylene chlo	0E+00	0E+00	0E+00			
28	Tetrachloroeth	0E+00	0E+00	0E+00			
29	Tetrachloroeth	0E+00	0E+00	0E+00			
30	Toluene	NA	NA	NA			
31	Trichloroethan	NA	NA	NA			
32	Trichloroethan	0E+00	0E+00	0E+00			
33	Trichloroethen	0E+00	0E+00	0E+00			
34	Vinyl acetate	NA	NA	NA			
35	Vinyl chloride	0E+00	0E+00	0E+00			
36	Xylenes (total	NA	NA	NA			
37	Bis(2-ethylhex	0E+00	0E+00	0E+00			
38	Di-n-butylphth	NA	NA	NA			
	TOTAL PATHWAY CANCER RISK	0E+00	0E+00	9E-08	0E+00	0E+00	0E+00

POPULATION TOTAL EXCESS RISK 9E-08

RANGE NAME: WS1

EXPOSURE AND RISK CALCULATION WORKSHEET

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP4
LAST UPDATED: 10/26/92

LAND USE: Current
POPULATION: Worker

EXPOSURE POINT: On-site (Worker)
MEDIUM: Soil
ROUTE: Oral

HIFs = 0.0E+00
HIFc = 1.2E-07
HIFl = 1.6E-08

		SUBCHRONIC					CHRONIC						LIFETIME					
	CHEMICAL NAME	Cs	HIFs	1	DIs	RfDS	HQs	Cc	HIFc	1	DIc	RfDC	HQc	Cl	HIFl	1	DIl	SF	RISK
1	Aluminum		0.0E+00		0.0E+00		ERR	1.3E+04	1.2E-07	1	1.6E-03	NA	NA	1.3E+04	1.6E-08	1	2.1E-04	NA	NA
2	Antimony							1.7E+01	1.2E-07	1	2.1E-06	4.0E-04	5E-03	1.7E+01	1.6E-08	1	2.8E-07	NA	NA
3	Arsenic							1.3E+01	1.2E-07	1	1.6E-06	3.0E-04	5E-03	1.3E+01	1.6E-08	1	2.1E-07	1.8E+00	4E-07
4	Barium							1.2E+02	1.2E-07	1	1.4E-05	7.0E-02	2E-04	1.2E+02	1.6E-08	1	1.9E-06	NA	NA
5	Beryllium							1.2E+00	1.2E-07	1	1.4E-07	5.0E-03	3E-05	1.2E+00	1.6E-08	1	1.9E-08	4.3E+00	8E-08
6	Cadmium (food)							9.1E+00	1.2E-07	1	1.1E-06	1.0E-03	1E-03	9.1E+00	1.6E-08	1	1.5E-07	NA	NA
7	Chromium							2.3E+02	1.2E-07	1	2.7E-05	5.0E-03	5E-03	2.3E+02	1.6E-08	1	3.7E-06	NA	NA
8	Cobalt							1.5E+01	1.2E-07	1	1.8E-06	NA	NA	1.5E+01	1.6E-08	1	2.4E-07	NA	NA
9	Copper (b)							5.1E+02	1.2E-07	1	6.1E-05	3.7E-02	2E-03	5.1E+02	1.6E-08	1	8.1E-06	NA	NA
10	Lead							5.3E+01	1.2E-07	1	6.4E-06	NA	NA	5.3E+01	1.6E-08	1	8.5E-07	NA	NA
11	Mercury							3.7E-01	1.2E-07	1	4.5E-08	3.0E-04	1E-04	3.7E-01	1.6E-08	1	5.9E-09	NA	NA
12	Nickel							1.7E+01	1.2E-07	1	2.0E-06	2.0E-02	1E-04	1.7E+01	1.6E-08	1	2.7E-07	NA	NA
13	Silver							1.7E+00	1.2E-07	1	2.1E-07	5.0E-03	4E-05	1.7E+00	1.6E-08	1	2.8E-08	NA	NA
14	Vanadium							4.8E+01	1.2E-07	1	5.8E-06	7.0E-03	8E-04	4.8E+01	1.6E-08	1	7.7E-07	NA	NA
15	Cyanide							0.0E+00	1.2E-07	1	0.0E+00	2.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
16	Ammonia-N							0.0E+00	1.2E-07	1	0.0E+00	9.7E-01	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
17	Nitrate+Nitrite							0.0E+00	1.2E-07	1	0.0E+00	1.0E-01	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
18	Acetone							0.0E+00	1.2E-07	1	0.0E+00	1.0E-01	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
19	Bromodichloromethane							0.0E+00	1.2E-07	1	0.0E+00	2.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	1.3E-01	0E+00
20	Butanone, 2-							0.0E+00	1.2E-07	1	0.0E+00	5.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
21	Chlorobenzene							0.0E+00	1.2E-07	1	0.0E+00	2.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
22	Chloroform							0.0E+00	1.2E-07	1	0.0E+00	1.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	6.1E-03	0E+00
23	Dichloroethane, 1,1-							0.0E+00	1.2E-07	1	0.0E+00	1.0E-01	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
24	Dichloroethene, 1,2- (total)							0.0E+00	1.2E-07	1	0.0E+00	9.0E-03	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
25	Ethylbenzene							0.0E+00	1.2E-07	1	0.0E+00	1.0E-01	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
26	Methyl-2-pentanone, 4-							0.0E+00	1.2E-07	1	0.0E+00	5.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
27	Methylene chloride							0.0E+00	1.2E-07	1	0.0E+00	6.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	7.5E-03	0E+00
28	Tetrachloroethane, 1,1,2,2-							0.0E+00	1.2E-07	1	0.0E+00	NA	NA	0.0E+00	1.6E-08	1	0.0E+00	2.0E-01	0E+00
29	Tetrachloroethene							0.0E+00	1.2E-07	1	0.0E+00	1.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	5.2E-02	0E+00
30	Toluene							0.0E+00	1.2E-07	1	0.0E+00	2.0E-01	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
31	Trichloroethane, 1,1,1-							0.0E+00	1.2E-07	1	0.0E+00	9.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
32	Trichloroethane, 1,1,2-							0.0E+00	1.2E-07	1	0.0E+00	4.0E-03	0E+00	0.0E+00	1.6E-08	1	0.0E+00	5.7E-02	0E+00
33	Trichloroethene (c)							0.0E+00	1.2E-07	1	0.0E+00	6.0E-03	0E+00	0.0E+00	1.6E-08	1	0.0E+00	1.1E-02	0E+00
34	Vinyl acetate							0.0E+00	1.2E-07	1	0.0E+00	2.0E-01	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
35	Vinyl chloride							0.0E+00	1.2E-07	1	0.0E+00	NA	NA	0.0E+00	1.6E-08	1	0.0E+00	1.9E+00	0E+00
36	Xylenes (total)							0.0E+00	1.2E-07	1	0.0E+00	2.0E+00	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA
37	Bis(2-ethylhexyl)phthalate							0.0E+00	1.2E-07	1	0.0E+00	2.0E-02	0E+00	0.0E+00	1.6E-08	1	0.0E+00	1.4E-02	0E+00
38	Di-n-butylphthalate							0.0E+00	1.2E-07	1	0.0E+00	1.0E-01	0E+00	0.0E+00	1.6E-08	1	0.0E+00	NA	NA

RANGE NAME: CSUM

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP4
LAST UPDATED: 10/26/92

CHRONIC EXPOSURE SUMMARY

Current
Worker

CHRONIC DAILY INTAKE (mg/kg/day)

		SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5	SCENARIO 6
		On-site (Wo	0	0	0	0	0
		Soil	0	0	0	0	0
		Oral	0	0	0	0	0
	CHEMICAL NAME	(FROM WS1)	(FROM WS2)	(FROM WS3)	(FROM WS4)	(FROM WS5)	(FROM WS6)
1	Aluminum	1.6E-03	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
2	Antimony	2.1E-06					
3	Arsenic	1.6E-06					
4	Barium	1.4E-05					
5	Beryllium	1.4E-07					
6	Cadmium (food)	1.1E-06					
7	Chromium	2.7E-05					
8	Cobalt	1.8E-06					
9	Copper (b)	6.1E-05					
10	Lead	6.4E-06					
11	Mercury	4.5E-08					
12	Nickel	2.0E-06					
13	Silver	2.1E-07					
14	Vanadium	5.8E-06					
15	Cyanide	0.0E+00					
16	Ammonia-N	0.0E+00					
17	Nitrate+Nitrit	0.0E+00					
18	Acetone	0.0E+00					
19	Bromodichlorom	0.0E+00					
20	Butanone, 2-	0.0E+00					
21	Chlorobenzene	0.0E+00					
22	Chloroform	0.0E+00					
23	Dichldroethane	0.0E+00					
24	Dichloroethene	0.0E+00					
25	Ethylbenzene	0.0E+00					
26	Methyl-2-penta	0.0E+00					
27	Methylene chlo	0.0E+00					
28	Tetrachloroeth	0.0E+00					
29	Tetrachloroeth	0.0E+00					
30	Toluene	0.0E+00					
31	Trichloroethan	0.0E+00					
32	Trichloroethan	0.0E+00					
33	Trichloroethen	0.0E+00					
34	Vinyl acetate	0.0E+00					
35	Vinyl chloride	0.0E+00					
36	Xylenes (total	0.0E+00					
37	Bis(2-ethylhex	0.0E+00					
38	Di-n-butylphth	0.0E+00					

CHRONIC RISK SUMMARY

Current
Worker

CHRONIC HAZARD QUOTIENT

		SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5	SCENARIO 6
		On-site (Wo	0	0	0	0	0
		Soil	0	0	0	0	0
		Oral	0	0	0	0	0
	CHEMICAL NAME	(FROM WS1)	(FROM WS2)	(FROM WS3)	(FROM WS4)	(FROM WS5)	(FROM WS6)
1	Aluminum	NA	0E+00	0E+00	0E+00	0E+00	0E+00
2	Antimony	5E-03					
3	Arsenic	5E-03					
4	Barium	2E-04					
5	Beryllium	3E-05					
6	Cadmium (food)	1E-03					
7	Chromium	5E-03					
8	Cobalt	NA					
9	Copper (b)	2E-03					
10	Lead	NA					
11	Mercury	1E-04					
12	Nickel	1E-04					
13	Silver	4E-05					
14	Vanadium	8E-04					
15	Cyanide	0E+00					
16	Ammonia-N	0E+00					
17	Nitrate+Nitrit	0E+00					
18	Acetone	0E+00					
19	Bromodichlorom	0E+00					
20	Butanone, 2-	0E+00					
21	Chlorobenzene	0E+00					
22	Chloroform	0E+00					
23	Dichldroethane	0E+00					
24	Dichloroethene	0E+00					
25	Ethylbenzene	0E+00					
26	Methyl-2-penta	0E+00					
27	Methylene chlo	0E+00					
28	Tetrachloroeth	NA					
29	Tetrachloroeth	0E+00					
30	Toluene	0E+00					
31	Trichloroethan	0E+00					
32	Trichloroethan	0E+00					
33	Trichloroethen	0E+00					
34	Vinyl acetate	0E+00					
35	Vinyl chloride	NA					
36	Xylenes (total	0E+00					
37	Bis(2-ethylhex	0E+00					
38	Di-n-butylphth	0E+00					
	PATHWAY SUM (HI)	2E-02	0E+00	0E+00	0E+00	0E+00	0E+00
	POPULATION TOTAL	2E-02					

ANGE NAME: LSUM

SITE NAME: HI-MILL
OPERABLE UNIT: DISK 2 (AVG)
FILE NAME: POP4
LAST UPDATED: 10/26/92

LIFETIME EXPOSURE SUMMARY

Current
Worker

LIFETIME AVERAGE DAILY INTAKE (mg/kg/day)

		SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5	SCENARIO 6
		On-site (No	0	0	0	0	0
		Soil	0	0	0	0	0
		Oral	0	0	0	0	0
	CHEMICAL NAME	(FROM WS1)	(FROM WS2)	(FROM WS3)	(FROM WS4)	(FROM WS5)	(FROM WS6)
1	Aluminum	2.1E-04	0.0E+00	0.0E+00	0.0E+00	0.0E+00	0.0E+00
1	Antimony	2.8E-07					
1	Arsenic	2.1E-07					
1	Barium	1.9E-06					
5	Beryllium	1.9E-08					
6	Cadmium (food)	1.5E-07					
7	Chromium	3.7E-06					
8	Cobalt	2.4E-07					
9	Copper (b)	8.1E-06					
10	Lead	8.5E-07					
11	Mercury	5.9E-09					
12	Nickel	2.7E-07					
13	Silver	2.8E-08					
14	Vanadium	7.7E-07					
15	Cyanide	0.0E+00					
16	Ammonia-N	0.0E+00					
17	Nitrate+Nitrit	0.0E+00					
18	Acetone	0.0E+00					
19	Bromodichlorom	0.0E+00					
20	Butanone, 2-	0.0E+00					
21	Chlorobenzene	0.0E+00					
22	Chloroform	0.0E+00					
23	Dichloroethane	0.0E+00					
24	Dichloroethene	0.0E+00					
25	Ethylbenzene	0.0E+00					
26	Methyl-2-penta	0.0E+00					
27	Methylene chlo	0.0E+00					
28	Tetrachloroeth	0.0E+00					
29	Tetrachloroeth	0.0E+00					
30	Toluene	0.0E+00					
31	Trichloroethan	0.0E+00					
32	Trichloroethan	0.0E+00					
33	Trichloroethen	0.0E+00					
34	Vinyl acetate	0.0E+00					
35	Vinyl chloride	0.0E+00					
36	Xylenes (total	0.0E+00					
37	Bis(2-ethylhex	0.0E+00					
38	Di-n-butylphth	0.0E+00					

LIFETIME RISK SUMMARY

Current
Worker

LIFETIME EXCESS CANCER RISK

		SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5	SCENARIO 6
		On-site (No	0	0	0	0	0
		Soil	0	0	0	0	0
		Oral	0	0	0	0	0
	CHEMICAL NAME	(FROM WS1)	(FROM WS2)	(FROM WS3)	(FROM WS4)	(FROM WS5)	(FROM WS6)
1	Aluminum	NA	0E+00	0E+00	0E+00	0E+00	0E+00
1	Antimony	NA					
1	Arsenic	4E-07					
1	Barium	NA					
5	Beryllium	0E-08					
6	Cadmium (food)	NA					
7	Chromium	NA					
8	Cobalt	NA					
9	Copper (b)	NA					
10	Lead	NA					
11	Mercury	NA					
12	Nickel	NA					
13	Silver	NA					
14	Vanadium	NA					
15	Cyanide	NA					
16	Ammonia-N	NA					
17	Nitrate+Nitrit	NA					
18	Acetone	NA					
19	Bromodichlorom	0E+00					
20	Butanone, 2-	NA					
21	Chlorobenzene	NA					
22	Chloroform	0E+00					
23	Dichloroethane	NA					
24	Dichloroethene	NA					
25	Ethylbenzene	NA					
26	Methyl-2-penta	NA					
27	Methylene chlo	0E+00					
28	Tetrachloroeth	0E+00					
29	Tetrachloroeth	0E+00					
30	Toluene	NA					
31	Trichloroethan	NA					
32	Trichloroethan	0E+00					
33	Trichloroethen	0E+00					
34	Vinyl acetate	NA					
35	Vinyl chloride	0E+00					
36	Xylenes (total	NA					
37	Bis(2-ethylhex	0E+00					
38	Di-n-butylphth	NA					
	TOTAL PATHWAY CANCER RISK	5E-07	0E+00	0E+00	0E+00	0E+00	0E+00
	POPULATION TOTAL EXCESS RISK	5E-07					

APPENDIX 6

SUMMARY OF SAMPLING DATA

This appendix presents a summary of all the soil, surface water, sediment and groundwater sampling data for the Hi-Mill site. Included here are all data used for selection of contaminants of concern as described in Section 2.0 and background data for soil, surface water and sediments.

The tables in this appendix are arranged to facilitate comparisons of site-related and other data within each medium. Table A6-1 summarizes surface and subsurface soil data and background soil data. Tables A6-2 and A6-3 summarize all surface water and sediment data, respectively, and the background data for each of these media. Table A6-4 summarizes all groundwater data.

TABLE A6-1 SUMMARY OF CONCENTRATIONS IN SURFACE, SUBSURFACE AND BACKGROUND SOIL SAMPLES AT MI-MILL

CHEMICAL NAME	SURFACE SOIL, mg/kg						SUBSURFACE SOIL, mg/kg						BACKGROUND SOIL, mg/kg					
	Freq. of Detection		Range of Detects		Range of Detection Limits		Freq. of Detection		Range of Detects		Range of Detection Limits		Freq. of Detection		Range of Detects		Range of Detection Limits	
	Hits	Total	Min.	Max.	Min.	Max.	Hits	Total	Min.	Max.	Min.	Max.	Hits	Total	Min.	Max.	Min.	Max.
INORGANICS																		
Aluminum	79	79	2130	27100			109	109	1670	27100			9	9	3900	26400		
Antimony	1	8	17.2	17.2	13	128	1	9	9.7	9.7	11.8	13.1	0	9			11.7	14.6
Arsenic	0	8	3.8	16			9	9	2.3	6.2			9	9	1.7	6.2		
Barium	7	8	30.3	130	105	105	9	9	7.475	144			8	9	18.6	130	9.6	9.6
Beryllium	6	8	0.36	1.2	0.29	2.5	8	9	0.27	0.66	0.24	0.24	3	9	0.29	1.2	0.23	0.27
Cadmium	7	8	0.8	10.6	0.63	0.63	8	9	0.89	1.3	0.5	0.5	6	9	0.64	1.9	0.46	0.53
Calcium	9	9	744	10700			9	9	21900	100250			8	9	294	18100	304	304
Chromium	79	79	4.5	4620			109	109	4.6	1620			9	9	7.05	224		
Cobalt	6	8	6.8	14.8	4.5	35	9	9	3.225	11.6			8	9	4.9	14.8	3.2	3.7
Copper	69	79	2.275	5010	2.3	2.6	96	109	2.375	4440	2.2	2.6	6	9	4	892	2.3	2.7
Cyanide	0	8			0.66	6.3	0	9			0.58	0.66	0	9			0.57	0.72
Iron	8	8	10300	43300			9	9	7010	28500			9	9	5645	43300		
Lead	8	8	14.9	60			9	9	6.2	22.5			9	9	3.9	251		
Magnesium	8	8	1610	8200			9	9	9640	27100			9	9	644	6200		
Manganese	8	8	223	764			9	9	146	634			9	9	80.3	619		
Mercury	0	8			0.1	0.66	1	10	0.89	0.89	0.09	0.13	1	9	0.22	0.22	0.09	0.12
Nickel	77	78	5	58.2	27.5	27.5	109	109	4.9	41.5			8	9	3.4	50.2	2.5	2.5
Potassium	7	8	469	3350	1970	1970	9	9	285	2450			7	9	289	3350	203	207
Selenium	0	8			0.26	2.5	0	9			0.23	1.3	3	9	0.28	0.4	0.23	0.27
Silver	0	79			2	22.5	3	109	1.2	12.5	0.94	2.9	0	9			2.1	2.6
Sodium	1	8	288	288	303	2710	2	9	349	349	258	278	2	9	288	290	248	310
Thallium	0	8			1	10	0	9			0.92	1	0	9			0.91	1.1
Vanadium	7	8	16.1	91.8	20	20	9	9	9.35	36			9	9	6.9	51.8		
Zinc	78	78	22	844			110	110	17.6	244			9	9	20.9	100		
VOLATILES																		
Acetone	0	14			0.011	0.14	2	48	0.014	0.024	0.011	0.15	0	10			0.011	0.11
Benzene	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Bromodichloromethane	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Bromoform	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Bromomethane	0	14			0.011	0.012	0	48			0.011	0.062	0	10			0.011	0.015
Butanone, 2-	0	14			0.011	0.012	0	48			0.011	0.062	0	10			0.006	0.021
Carbon disulfide	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Carbon tetrachloride	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Chlorobenzene	0	14			0.005	0.006	3	48	0.0028	0.014	0.0059	0.031	0	10			0.006	0.007
Chloroethane	0	14			0.011	0.012	0	48			0.011	0.062	0	10			0.011	0.015
Chloroethyl vinyl ether, 2-	0	14			0.011	0.012	0	36			0.011	0.013	0	10			0.011	0.015
Chloroform	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Chloromethane	0	14			0.011	0.012	0	48			0.011	0.062	0	10			0.011	0.015
Dibromochloromethane	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Dichloroethane, 1,1-	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Dichloroethane, 1,2-	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Dichloroethene, 1,1-	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Dichloroethene, 1,2- (total)	0	14			0.005	0.016	12	48	0.002	0.13	0.0059	0.031	0	10			0.006	0.007
Dichloropropane, 1,2-	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Dichloropropene, cis-1,3-	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Dichloropropene, trans-1,3-	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Ethylbenzene	0	14			0.005	0.006	2	48	0.002	0.0025	0.0059	0.031	0	10			0.006	0.007
Hexanone, 2-	0	14			0.011	0.012	0	48			0.011	0.062	0	10			0.011	0.015
Methyl-2-pentanone, 4-	0	14			0.011	0.012	1	48	0.005	0.005	0.011	0.062	0	10			0.011	0.015
Methylene chloride	0	14			0.006	0.016	1	48	0.0051	0.0051	0.0059	0.046	0	10			0.006	0.011
Styrene	0	14			0.005	0.006	0	48			0.0059	0.031	0	10			0.006	0.007
Tetrachloroethane, 1,1,2,2-	0	14			0.005	0.006	1	48	0.00275	0.00275	0.0059	0.031	0	10			0.006	0.007
Tetrachloroethene	0	14			0.005	0.006	2	48	0.068	0.23	0.0059	0.0069	0	10			0.006	0.007
Toluene	1	14	0.14	0.14	0.006	0.009	9	48	0.0022	0.037	0.0059	0.031	1	10	0.037	0.037	0.006	0.007
Trichloroethane, 1,1,1-	1	14	0.002	0.002	0.005	0.006	4	48	0.001	0.011	0.0059	0.031	0	10			0.006	0.007

TABLE A6-1 SUMMARY OF CONCENTRATIONS IN SURFACE, SUBSURFACE AND BACKGROUND SOIL SAMPLES AT HI-MILL

CHEMICAL NAME	SURFACE SOIL, mg/kg						SUBSURFACE SOIL, mg/kg						BACKGROUND SOIL, mg/kg					
	Freq. of Detection		Range of Detects		Range of Detection Limits		Freq. of Detection		Range of Detects		Range of Detection Limits		Freq. of Detection		Range of Detects		Range of Detection Limits	
	Hits	Total	Min.	Max.	Min.	Max.	Hits	Total	Min.	Max.	Min.	Max.	Hits	Total	Min.	Max.	Min.	Max.
Trichloroethane, 1,1,2-	0	14			0.005	0.006	1	48	0.00275	0.00275	0.0059	0.031	0	10			0.006	0.007
Trichloroethene	11	14	0.002	0.043	0.006	0.006	31	48	0.001	6.05	0.0059	0.0063	0	10			0.006	0.007
Vinyl acetate	0	14			0.011	0.012	0	48			0.011	0.062	0	10			0.011	0.013
Vinyl chloride	0	14			0.011	0.012	0	48			0.011	0.062	0	10			0.011	0.013
Xylenes (total)	0	14			0.005	0.006	3	49	0.002	0.002	0.002	0.031	0	10			0.006	0.007
SEMIVOLATILES (a)																		
Acenaphthene							0	3			0.39	0.43	0	10			0.38	0.49
Acenaphthylene							0	3			0.39	0.43	0	10			0.38	0.49
Anthracene							0	3			0.39	0.43	0	10			0.38	0.49
Benzo(a)anthracene							0	3			0.39	0.43	1	10	0.19	0.19	0.38	0.45
Benzo(a)pyrene							0	3			0.39	0.43	1	10	0.19	0.19	0.38	0.45
Benzo(b)fluoranthene							0	3			0.39	0.43	1	10	0.44	0.44	0.38	0.45
Benzo(g,h,i)perylene							0	3			0.39	0.43	1	10	0.15	0.15	0.38	0.45
Benzo(k)fluoranthene							0	3			0.39	0.43	0	10			0.38	0.49
Benzoic acid							0	3			1.9	2.1	0	10			1.9	2.4
Benzyl alcohol							0	3			0.39	0.43	0	10			0.38	0.49
Bis(2-chloroethoxy)methane							0	3			0.39	0.43	0	10			0.38	0.49
Bis(2-chloroethyl)ether							0	3			0.39	0.43	0	10			0.38	0.49
Bis(2-chloroisopropyl)ether							0	3			0.39	0.43	0	10			0.38	0.49
Bis(2-ethylhexyl)phthalate							2	3	0.21	0.29	0.39	0.39	2	10	0.15	0.59	0.38	0.45
Bromophenyl-phenylether, 4-							0	3			0.39	0.43	0	10			0.38	0.49
Butylbenzylphthalate							0	3			0.39	0.43	1	10	0.049	0.049	0.38	0.45
Chloro-3-methylphenol, 4-							0	3			0.39	0.43	0	10			0.38	0.49
Chloroaniline, 4-							0	3			0.39	0.43	0	10			0.38	0.49
Chloronaphthalene, 2-							0	3			0.39	0.43	0	10			0.38	0.49
Chlorophenol, 2-							0	3			0.39	0.43	0	10			0.38	0.49
Chlorophenyl-phenylether, 4-							0	3			0.39	0.43	0	10			0.38	0.49
Chrysene							0	3			0.39	0.43	1	10	0.29	0.29	0.38	0.45
Di-n-butylphthalate							1	3	0.12	0.12	0.39	0.43	2	10	0.049	0.14	0.38	0.44
Di-n-octylphthalate							0	3			0.39	0.43	0	10			0.38	0.49
Dibenz(a,h)anthracene							0	3			0.39	0.43	1	10	0.049	0.049	0.38	0.45
Dibenzofuran							0	3			0.39	0.43	0	10			0.38	0.49
Dichlorobenzene, 1,2-							0	3			0.39	0.43	0	10			0.38	0.49
Dichlorobenzene, 1,3-							0	3			0.39	0.43	0	10			0.38	0.49
Dichlorobenzene, 1,4-							0	3			0.39	0.43	0	10			0.38	0.49
Dichlorobenzidine, 3,3'-							0	3			0.78	0.86	0	13			0.49	0.9
Dichlorophenol, 2,4-							0	3			0.39	0.43	0	10			0.38	0.49
Diethylphthalate							0	3			0.39	0.43	0	10			0.38	0.49
Dimethylphenol, 2,4-							0	3			0.39	0.43	0	10			0.38	0.49
Dimethylphthalate							0	3			0.39	0.43	0	10			0.38	0.49
Dinitro-2-methylphenol, 4,6-							0	3			1.9	2.1	0	10			1.9	2.4
Dinitrophenol, 2,4-							0	3			1.9	2.1	0	10			1.9	2.4
Dinitrotoluene, 2,4-							0	3			0.39	0.43	0	10			0.38	0.49
Dinitrotoluene, 2,6-							0	3			0.39	0.43	0	10			0.38	0.49
Fluoranthene							0	3			0.39	0.43	2	10	0.077	0.63	0.38	0.45
Fluorene							0	3			0.39	0.43	0	10			0.38	0.49
Hexachlorobenzene							0	3			0.39	0.43	0	10			0.38	0.49
Hexachlorobutadiene							0	3			0.39	0.43	0	10			0.38	0.49
Hexachlorocyclopentadiene							0	3			0.39	0.43	0	10			0.38	0.49
Hexachloroethane							0	3			0.39	0.43	0	10			0.38	0.49
Indeno(1,2,3-cd)pyrene							0	3			0.39	0.43	1	10	0.15	0.15	0.38	0.45
Isophorone							0	3			0.39	0.43	0	10			0.38	0.49
Methylnaphthalene, 2-							0	3			0.39	0.43	0	10			0.38	0.49
Methylphenol, 2-							0	3			0.39	0.43	0	10			0.38	0.49
Methylphenol, 4-							0	3			0.39	0.43	0	10			0.38	0.49
N-Nitroso-di-n-propylamine							0	3			0.39	0.43	0	10			0.38	0.49

TABLE A6-1 SUMMARY OF CONCENTRATIONS IN SURFACE, SUBSURFACE AND BACKGROUND SOIL SAMPLES AT NI-MILL

CHEMICAL NAME	SURFACE SOIL, mg/kg						SUBSURFACE SOIL, mg/kg						BACKGROUND SOIL, mg/kg					
	Freq. of Detection		Range of Detects		Range of Detection Limits		Freq. of Detection		Range of Detects		Range of Detection Limits		Freq. of Detection		Range of Detects		Range of Detection Limits	
	Hits	Total	Min.	Max.	Min.	Max.	Hits	Total	Min.	Max.	Min.	Max.	Hits	Total	Min.	Max.	Min.	Max.
N-Nitrosodiphenylamine							0	3			0.39	0.43	0	10			0.38	0.49
Naphthalene							0	3			0.39	0.43	0	10			0.38	0.49
Nitroaniline, 2-							0	3			1.9	2.1	0	10			1.9	2.4
Nitroaniline, 3-							0	3			1.9	2.1	0	10			1.9	2.4
Nitroaniline, 4-							0	3			1.9	2.1	0	10			1.9	2.4
Nitrobenzene							0	3			0.39	0.43	0	10			0.38	0.49
Nitrophenol, 2-							0	3			0.39	0.43	0	10			0.38	0.49
Nitrophenol, 4-							0	3			1.9	2.1	0	10			1.9	2.4
Pentachlorophenol							0	3			1.9	2.1	0	10			1.9	2.4
Phenanthrene							0	3			0.39	0.43	1	10	0.24	0.24	0.38	0.45
Phenol							0	3			0.39	0.43	0	10			0.38	0.49
Pyrene							0	3			0.39	0.43	1	10	0.39	0.39	0.38	0.45
Trichlorobenzene, 1,2,4-							0	3			0.39	0.43	0	10			0.38	0.49
Trichlorophenol, 2,4,5-							0	3			0.39	0.43	0	10			0.38	0.49
Trichlorophenol, 2,4,6-							0	3			0.39	0.43	0	10			0.38	0.49
PESTICIDES/PCBs																		
Aldrin							0	3			0.0094	0.01	0	11			0.0092	11
Alpha Chlordane							0	3			0.094	0.1	0	11			0.092	110
Alpha-BHC							0	3			0.0094	0.01	0	11			0.0092	11
Arochlor-1016							0	3			0.094	0.1	0	11			0.092	110
Arochlor-1221							0	3			0.094	0.1	0	11			0.092	110
Arochlor-1232							0	3			0.094	0.1	0	11			0.092	110
Arochlor-1242							0	3			0.094	0.1	0	11			0.092	110
Arochlor-1248							0	3			0.094	0.1	0	11			0.092	110
Arochlor-1254							0	3			0.094	0.1	0	11			0.092	110
Arochlor-1260							0	3			0.19	0.2	0	11			0.18	220
Beta-BHC							0	3			0.19	0.2	0	11			0.18	220
DDD, 4,4-							0	3			0.0094	0.01	0	11			0.0092	11
DDE, 4,4-							0	3			0.019	0.02	0	11			0.018	22
DDT, 4,4-							0	3			0.019	0.02	0	11			0.018	22
Delta-BHC							0	3			0.019	0.02	0	11			0.018	22
Dieldrin							0	3			0.0094	0.01	0	11			0.0092	11
Endosulfan I							0	3			0.019	0.02	0	11			0.018	22
Endosulfan II							0	3			0.0094	0.01	0	11			0.0092	11
Endosulfan sulfate							0	3			0.019	0.02	0	11			0.018	22
Endrin							0	3			0.019	0.02	0	11			0.018	22
Endrin ketone							0	3			0.019	0.02	0	11			0.018	22
Gamma Chlordane							0	3			0.019	0.02	0	11			0.018	22
Gamma-BHC							0	3			0.094	0.1	0	11			0.092	110
Heptachlor							0	3			0.0094	0.01	0	11			0.0092	11
Heptachlor epoxide							0	3			0.0094	0.01	0	11			0.0092	11
Methoxychlor							0	3			0.0094	0.01	0	11			0.0092	11
Toxaphene							0	3			0.094	0.1	0	11			0.092	110
							0	3			0.19	0.2	0	11			0.18	220

(a) Semivolatiles and pesticides were not analysed for in surface soils.

TABLE A6-2 SUMMARY OF CONCENTRATIONS IN SURFACE W[illegible] AND BACKGROUND SURFACE WATER SAMPLES AT HI-MILL

	SURFACE WATER, mg/L						BACKGROUND SURFACE WATER, mg/L					
	Freq. of Detection		Range of Detects		Range of Detection Limits		Freq. of Detection		Range of Detects		Range of Detection Limits	
CHEMICAL NAME	Hits	Total	Min.	Max.	Min.	Max.	Hits	Total	Min.	Max.	Min.	Max.
INORGANICS												
Aluminum	1	9	5.36	5.36	0.085	0.085	0	4			0.085	0.085
Ammonia-N							4	4	0.05	0.16		
Antimony	0	3			0.051	0.051	1	1	0.0654	0.0654		
Arsenic	0	3			0.003	0.003	0	1			0.003	0.003
Barium	0	3			0.042	0.042	0	1			0.042	0.042
Beryllium	0	3			0.001	0.001	0	1			0.001	0.001
Cadmium	0	3			0.002	0.002	0	1			0.002	0.002
Calcium	3	3	22	44.05			1	1	26.5	26.5		
Chromium	2	9	0.0064	0.0139	0.007	0.0285	0	4			0.007	0.0093
Chromium (VI)	0	9			0.01	0.01	0	4			0.01	0.01
Cobalt	0	3			0.014	0.014	0	1			0.014	0.014
Copper	0	9			0.01	0.0157	0	4			0.01	0.0195
Cyanide	0	4			0.01	0.01	0	2			0.01	0.01
Iron	3	3	0.07965	0.625			0	1			0.039	0.039
Lead	2	3	0.0031	0.00425	0.002	0.002	1	1	0.0033	0.0033		
Magnesium	3	3	5.26	11.65			1	1	5.05	5.05		
Manganese	3	3	0.071	0.378			1	1	0.0073	0.0073		
Mercury	0	3			0.0002	0.0002	0	1			0.0002	0.0002
Nickel	5	9	0.143	0.302	0.011	0.122	2	4	0.0138	0.0178	0.011	0.011
Nitrate+Nitrite	0	2			0.05	0.05	4	4	0.07	0.18		
Potassium	3	3	2.7	3.71			1	1	0.817	0.817		
Selenium	0	3			0.001	0.001	0	1			0.001	0.001
Silver	3	9	0.0068	0.0114	0.009	0.009	2	4	0.009	0.0125	0.009	0.009
Sodium	3	3	8.72	25.95			1	1	2.62	2.62		
Thallium	0	3			0.004	0.004	0	1			0.004	0.004
Vanadium	0	3			0.008	0.008	0	1			0.008	0.008
Zinc	1	9	0.012025	0.01203	0.006	0.0131	1	4	0.0124	0.0124	0.006	0.0118

TABLE A6-3 SUMMARY OF CONCENTRATIONS IN SEDIMENT AND BACKGROUND SEDIMENT SAMPLES AT HI-MILL

	SEDIMENT, mg/kg						BACKGROUND SEDIMENT, mg/kg					
	Freq. of Detection		Range of Detects		Range of Detection Limits		Freq. of Detection		Range of Detects		Range of Detection Limits	
CHEMICAL NAME	Hits	Total	Min.	Max.	Min.	Max.	Hits	Total	Min.	Max.	Min.	Max.
INORGANICS												
Aluminum	25	25	1360	33900			4	4	964	3610		
Antimony	0	9			12.6	62.3	0	1			144	144
Arsenic	9	9	1.2	9.5			0	1			9.5	8.5
Barium	9	9	45.7	265			0	1			118	118
Beryllium	3	9	0.665	1.9	0.77	3.3	0	1			2.8	2.8
Cadmium	4	9	1.5	6.2	3.1	13.1	0	1			5.6	5.6
Calcium	9	9	7700	35150			1	1	21800	21800		
Chromium	24	25	17.3	2370	7.3	7.3	2	4	22.9	37.1	20.3	29.8
Chromium (VI)	0	19			0.12	1.1	0	4			1.6	2
Cobalt	6	9	5.5	11.7	8.2	13.1	0	1			39.4	39.4
Copper	23	25	6.35	17000	2.8	10.4	1	4	34.8	34.8	28.2	42.6
Cyanide	0	3			0.62	0.96	0	1			7	7
Iron	9	9	8420	21500			1	1	9280	9280		
Lead	9	9	11.3	137			1	1	61.1	61.1		
Magnesium	9	9	2508	24850			0	1			2390	2390
Manganese	9	9	52.9	227			1	1	167	167		
Mercury	1	9	0.73	0.73	0.105	1.6	0	1			1.2	1.2
Nickel	24	25	7.3	41.9	21.8	21.8	0	4			31	46.8
Potassium	9	9	1200	2530			0	1			2220	2220
Selenium	1	9	0.65	0.65	0.25	65.6	0	1			2.8	2.8
Silver	2	25	4.8	9.6	2.2	17.8	0	4			25.4	38.3
Sodium	4	9	504	1410	938	4800	1	1	4090	4090		
Thallium	0	9			0.77	3.3	0	1			11.3	11.3
Vanadium	8	9	14.9	43.6	13.1	13.1	0	1			22.5	22.5
Zinc	25	25	41.1	1200			2	4	71.6	122	18.2	25.5

TABLE A6-4 SUMMARY OF CONCENTRATIONS IN GROUNDWATER SAMPLES AT HI-MILL

	GROUNDWATER, mg/L					
	Freq. of Detection		Range of Detects		Range of Detection Limits	
CHEMICAL NAME	Hits	Total	Min.	Max.	Min.	Max.
INORGANICS						
Aluminum	14	68	0.0588	233	0.055	0.114
Ammonia-N	17	24	0.05	2.2	0.05	0.05
Antimony	1	15	0.0444	0.0444	0.044	0.056
Arsenic	3	15	0.0042	0.01025	0.001	0.003
Barium	10	15	0.0223	0.0873	0.023	0.042
Beryllium	1	15	0.001	0.001	0.001	0.002
Cadmium	0	15			0.002	0.004
Calcium	15	15	59	474		
Chromium	9	68	0.00575	0.552	0.005	0.0302
Cobalt	3	15	0.00725	0.0225	0.004	0.014
Copper	11	68	0.0052	0.75	0.00475	0.0338
Cyanide	1	7	0.037	0.037	0.01	0.01
Iron	10	15	0.0478	13.2	0.0128	0.039
Lead	2	15	0.0025	0.01085	0.001	0.0032
Magnesium	15	15	18	529		
Manganese	14	15	0.0462	1.86	0.001	0.001
Mercury	2	15	0.0002	0.00036	0.0002	0.0002
Nickel	25	68	0.0104	0.671	0.009	0.019
Nitrate + Nitrite	13	24	0.05	16	0.05	0.05
Potassium	13	15	0.655	11.5	0.962	0.962
Selenium	1	15	0.0011	0.0011	0.001	0.005
Silver	1	68	0.0146	0.0146	0.0065	0.09
Sodium	15	15	3.45	579		
Thallium	0	15			0.001	0.004
Vanadium	4	15	0.0079	0.02225	0.005	0.008
Zinc	22	68	0.0045	2.19	0.004	0.029563
VOLATILES						
Acetone	7	56	0.002	0.068	0.01	0.5
Benzene	0	56			0.005	0.5
Bromodichloromethane	1	56	0.001	0.001	0.005	0.5
Bromoform	0	56			0.005	0.5
Bromomethane	0	56			0.005	0.5
Butanone, 2-	1	56	0.028	0.028	0.005	0.5
Carbon disulfide	0	56			0.005	0.5
Carbon tetrachloride	0	56			0.005	0.5
Chlorobenzene	0	56			0.005	0.5
Chloroethane	0	56			0.01	0.5
Chloroethyl vinyl ether, 2-	0	45			0.01	1
Chloroform	1	56	0.002	0.002	0.005	0.5
Chloromethane	0	56			0.01	0.5
Dibromochloromethane	0	56			0.005	0.5
Dichloroethane, 1,1-	1	56	0.002	0.002	0.005	0.5
Dichloroethane, 1,2-	0	56			0.005	0.5
Dichloroethene, 1,1-	0	56			0.005	0.5
Dichloroethene, 1,2- (total)	12	56	0.002	1.4	0.005	0.01
Dichloropropane, 1,2-	0	56			0.005	0.5
Dichloropropene, cis-1,3-	0	56			0.005	0.5
Dichloropropene, trans-1,3-	0	56			0.005	0.5
Ethylbenzene	0	56			0.005	0.5
Hexanone, 2-	0	56			0.01	0.5
Methyl-2-pentanone, 4-	1	56	0.001	0.001	0.01	0.5
Methylene chloride	0	56			0.01	0.5
Styrene	0	56			0.005	0.5
Tetrachloroethane, 1,1,2,2-	0	56			0.005	0.5
Tetrachloroethene	0	56			0.005	0.5
Toluene	2	56	0.002	0.003	0.005	0.5
Trichloroethane, 1,1,1-	2	56	0.001	0.1	0.005	0.05
Trichloroethane, 1,1,2-	0	56			0.005	0.5
Trichloroethene	12	56	0.002	6.7	0.005	0.01
Vinyl acetate	1	47	0.01	0.01	0.01	0.5
Vinyl chloride	3	56	0.0035	0.068	0.01	0.5

TABLE A6-4 SUMMARY OF CONCENTRATIONS IN GROUNDWATER SAMPLES AT HI-MILL

CHEMICAL NAME	GROUNDWATER, mg/L					
	Freq. of Detection		Range of Detects		Range of Detection Limits	
	Hits	Total	Min.	Max.	Min.	Max.
Xylenes (total)	1	56	0.003	0.003	0.005	0.5
SEMIVOLATILES						
Acenaphthene	0	3			0.01	0.01
Acenaphthylene	0	3			0.01	0.01
Anthracene	0	3			0.01	0.01
Benzo(a)anthracene	0	3			0.01	0.01
Benzo(a)pyrene	0	3			0.01	0.01
Benzo(b)fluoranthene	0	3			0.01	0.01
Benzo(g,h,i)perylene	0	3			0.01	0.01
Benzo(k)fluoranthene	0	3			0.01	0.01
Benzoic acid	0	3			0.05	0.05
Benzyl alcohol	0	3			0.01	0.01
Bis(2-chloroethoxy)methane	0	3			0.01	0.01
Bis(2-chloroethyl)ether	0	3			0.01	0.01
Bis(2-chloroisopropyl)ether	0	3			0.01	0.01
Bis(2-ethylhexyl)phthalate	0	3			0.01	0.01
Bromophenyl-phenylether, 4-	0	3			0.01	0.01
Butylbenzylphthalate	0	3			0.01	0.01
Chloro-3-methylphenol	0	3			0.01	0.01
Chloroaniline, 4-	0	3			0.01	0.01
Chloronaphthalene, 2-	0	3			0.01	0.01
Chlorophenol, 2-	0	3			0.01	0.01
Chlorophenyl-phenylether, 4-	0	3			0.01	0.01
Chrysene	0	3			0.01	0.01
Di-n-butylphthalate	1	3	0.0065	0.0065	0.01	0.01
Di-n-octylphthalate	0	3			0.01	0.01
Dibenz(a,h)anthracene	0	3			0.01	0.01
Dibenzofuran	0	3			0.01	0.01
Dichlorobenzene, 1,2-	0	3			0.01	0.01
Dichlorobenzene, 1,3-	0	3			0.01	0.01
Dichlorobenzene, 1,4-	0	3			0.01	0.01
Dichlorobenzidine, 3,3'-	0	3			0.02	0.02
Dichlorophenol, 2,4-	0	3			0.01	0.01
Diethylphthalate	0	3			0.01	0.01
Dimethylphenol, 2,4-	0	3			0.01	0.01
Dimethylphthalate	0	3			0.01	0.01
Dinitro-2-methylphenol, 4,6-	0	3			0.05	0.05
Dinitrophenol, 2,4-	0	3			0.05	0.05
Dinitrotoluene, 2,4-	0	3			0.01	0.01
Dinitrotoluene, 2,6-	0	3			0.01	0.01
Fluoranthene	0	3			0.01	0.01
Fluorene	0	3			0.01	0.01
Hexachlorobenzene	0	3			0.01	0.01
Hexachlorobutadiene	0	3			0.01	0.01
Hexachlorocyclopentadiene	0	3			0.01	0.01
Hexachloroethane	0	3			0.01	0.01
Indeno(1,2,3-cd)pyrene	0	3			0.01	0.01
Isophorone	0	3			0.01	0.01
Methylnaphthalene, 2-	0	3			0.01	0.01
Methylphenol, 2-	0	3			0.01	0.01
Methylphenol, 4-	0	3			0.01	0.01
N-Nitroso-di-n-propylamine	0	3			0.01	0.01
N-Nitrosodiphenylamine	0	3			0.01	0.01
Naphthalene	0	3			0.01	0.01
Nitroaniline, 2-	0	3			0.05	0.05
Nitroaniline, 3-	0	3			0.05	0.05
Nitroaniline, 4-	0	3			0.05	0.05
Nitrobenzene	0	3			0.01	0.01
Nitrophenol, 2-	0	3			0.01	0.01
Nitrophenol, 4-	0	3			0.05	0.05
Pentachlorophenol	0	3			0.05	0.05
Phenanthrene	0	3			0.01	0.01

TABLE A6-4 SUMMARY OF CONCENTRATIONS IN GROUNDWATER SAMPLES AT HI-MILL

	GROUNDWATER, mg/L					
	Freq. of Detection		Range of Detects		Range of Detection Limits	
CHEMICAL NAME	Hits	Total	Min.	Max.	Min.	Max.
Phenol	0	3			0.01	0.01
Pyrene	0	3			0.01	0.01
Trichlorobenzene, 1,2,4-	0	3			0.01	0.01
Trichlorophenol, 2,4,5-	0	3			0.01	0.01
Trichlorophenol, 2,4,6-	0	3			0.01	0.01